Jan. 25 Cen

# Science and Invention


AIRPLANE
MOTOR LIFE-BOAT

*See Page 790*

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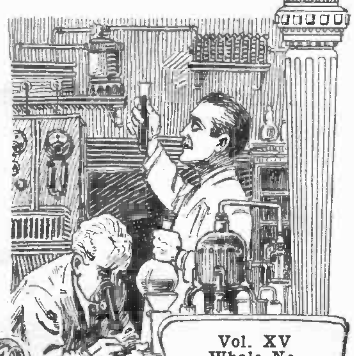
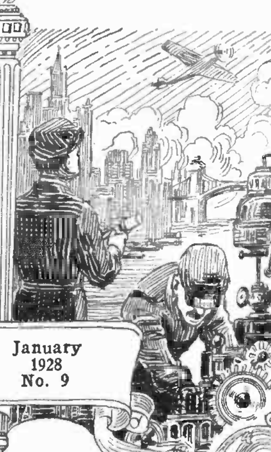


# Science and Invention

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***Thought Concentrator!***

The American public is forever being humbugged and a brand new, worthless device known as a "thought concentrator" is now being foisted upon them. Read the exposé in the next issue.

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A very interesting article showing graphically the tremendous advance in size and weight of modern locomotives compared to early models.

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A new theatrical stunt in which a grand piano, together with the pianist, whirls through the air.

***Three Tube A.C. Set***

This three tube A.C. set will appeal to thousands of people, as it is very simple to build.

## CONTENTS OF THIS NUMBER




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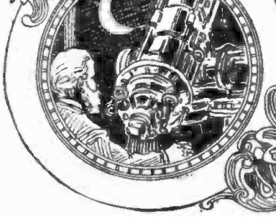


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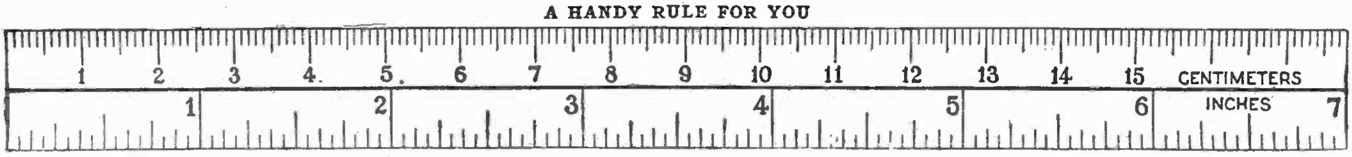
A HANDY RULE FOR YOU



*When I first started making real important money I used to go down to the bank, draw out a roll—and just thumb it over in my office and grin! That's how good it felt to get success and big money, after five years at a low-paid job.*

# Success and Big Money Were For Others, Not Me

## *Believe It or Not, That Was What I Thought of Myself—Just Twelve Short Months Ago*

I'M telling you, just one year ago I'd never seen a hundred dollar bill in my life outside of a bank.

You'd think I'm kidding you if you saw the fine Radio business I own now. But it's gospel truth. Just twelve months ago I was only a poorly paid clerk, and I thought success had passed me by.

All my crowd in those days—the fellows I met in the pool-hall and at the bowling alleys—said a fellow had to *have* money to make money. They claimed there was no chance for a fellow whose family didn't have money or some business to start him out in. And I'd decided they must be right.

I guess at that time I had just about given up hope. I thought there must be some kind of a mystery about making a lot of money. But I was due for a big awakening. Did I get it? Oh, boy! Read my story and judge for yourself.

IT all started one day last summer, when Helen, the girl I wanted to marry, was leaving for the seashore. Of course I went to the station to see her off.

As I stepped onto the station platform Bob Oakes and Wilmer Pratt had just rolled up in their cars. They climbed out with their arms full of bundles—books, expensive candy, flowers, all sorts of things. Well sir, I wish I could have swallowed in one gulp the little box of drugstore candy I had bought for Helen—it certainly looked pitiful beside all that stuff.

We three stood there talking to Helen until train-time, while Helen's mother looked me up and down. Like any young girl's mother would, she had my financial standing already sized up within thirty-five cents. Cheap suit, cheap hat, she took it all in. And you could see on her face all the time what a lot of nerve she thought I had to give Bob and Wilmer a run for Helen.

Well, to make a long story short, Helen was nice, but her mother stood there looking scornful whenever she glanced my way, and she hardly spoke to me at all. I felt about as welcome as the measles, and as uncomfortable as the itch. I began to wish that I and my cheap suit and cheap hat could sink through the floor, but I stayed there and stuck it out.

WHEN Helen's train finally left, I slunk home, ashamed and humiliated. I went upstairs to my room and sat there with a lump in my throat, getting hotter and hotter and more ashamed of myself. Then I began to see red and redder.

Finally I jumped up and banged the table. "I'll show 'em," I growled through clenched teeth. "There *must* be some way for a man to make *real money!*" An idea suddenly flashed through my head.

Hastily I began thumbing the pages of a magazine on the table, searching for an advertisement that I'd seen many times, but passed up without thinking, an advertisement telling of big opportunities for trained men to succeed in the great new Radio field. With the advertisement was a coupon offering a big free book full of information. I sent the coupon in, and in a few days received a handsome book, telling about opportunities in the Radio field and how a man can prepare quickly and easily at home to take advantage of these opportunities. I read the book carefully and when I finished it I made my decision.

WHAT'S happened in the twelve months since that day, as I've already told you, seems almost like a dream to me now. For ten of those twelve months I've had a Radio business of my own! At first, of course, I started it as a little proposition on the side, under the guidance of the National Radio Institute, the outfit that gave me my Radio training. It wasn't long before I was getting so much to do in the Radio line that I quit my measly little clerical job, and devoted my full time to my Radio business.

Since that time I've gone right on up, always under the watchful guidance of my friends at the National Radio Institute. They would have given me just as much help, too, if I had wanted to follow some other line of Radio besides building my own retail business—such as broadcasting, manufacturing, experimenting, sea operating, or any of the score of lines they prepare for you. And to think that until that day I sent for their eye-opening book, I'd been wailing "I never had a chance!"

NOW I'm making real money, own a good car, stand high in my town, can borrow money at the bank any time I want it. I'm getting some real *fun* and *enjoyment* out of life, not just *existing* from pay-day to pay-day.

And—just listen to this! Bob was in my place only the other day, and asked me for a job! Wilmer is still getting along pretty well on his father's money, but he'd trade places with me any day.

And Helen? Well—the honeymoon will be spent in Honolulu, starting two months from tomorrow!

HERE'S a real tip. Think it over—are you satisfied? Are you making enough money, at work that you like?

This new Radio game is a live-wire field of golden rewards. The work in any of the 20 different lines of Radio, is fascinating, absorbing, well paid. The National Radio Institute—oldest and largest Radio home-study in the world—will train you inexpensively in your own home to know Radio from A to Z and to increase your earnings in the Radio field.

Take another tip—No matter what your plans are, no matter how much or how little you know about Radio—clip the coupon below and look their free book over. The information it will give you is worth a few minutes of anybody's time. You will place yourself under no obligation—the book is free, and is gladly sent to anyone who wants to know about Radio. Just address: J. E. Smith, President, National Radio Institute, Dept. 1T, Washington, D. C.

J. E. SMITH, President.
National Radio Institute,
Dept. 1T, Washington, D. C.

Dear Mr. Smith:

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S. & I.-1-'28

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Whole No. 177

# Science and Invention

January, 1928
No. 9

HUGO GERNSBACK, *Editor-in-Chief*
H. WINFIELD SECOR, *Managing Editor*
DR. T. O'CONOR SLOANE, PH.D., *Associate Editor*
Editorial and General Offices - - 230 Fifth Avenue, New York

*"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact"* - - - *HUXLEY*

# WEATHER CONTROL

By HUGO GERNSBACK

FOR many years, the idea of controlling weather artificially has been discussed by scientists and laymen alike. Untold hundreds of experiments toward the ultimate realization of this object have been made, and reams of paper have been written and printed on all sorts of proposals for controlling the weather artificially. Let us first see what is really meant by weather control. In popular parlance, it means the artificial creation of good or bad weather, that is, sunshine or rain. The farmer wants, and needs, rain at certain times of the year. The city man wants clear blue skys practically at all times. These are the popular conceptions of the ends to be attained by weather control.

To the scientists, it means much more. It means for instance with him, whether it is feasible to control weather in all its phases, from all viewpoints, which applies to rain, fair weather, heat, cold, thunderstorms, hail, etc.

We may rule out immediately, the possibility of a human agency ever being able to control weather on a large scale, such as for instance, creating artificially a summer climate over a certain city or large area, let us say, while the rest of the surrounding territory is freezing, unless, of course, the whole city or such area were to be enclosed in glass or a glass substitute. Even if it were possible to create an artificially heated area, it could not be maintained at a high temperature even for a single hour, because the heated air would go upwards, while the cold air would rush in from the outside and it would be an impossible or at least an uneconomical problem to heat a sufficient amount of air at all times to keep up with the inrush of the cold air. At least, this could not be done in a practical sense, because the expense would be out of keeping with the results accomplished.

But when it comes to control weather from the popular standpoint, that is, to create rain artificially, or to clear a certain predetermined area from clouds, this comes within the realms of possibility and may probably be put into effect at some not too distant date.

Many schemes have been evolved to produce rain. Rain *can* be produced artificially. For instance, the setting a forest on fire, or burning over of a large prairie, is almost sure to bring rain in its wake. The cost, however, would be absolutely prohibitive. There are, however, other elements at our disposal to produce rain, and it is conceivable that it will be done sometime in the future. When the proper means have been evolved, which no doubt will be found sooner or later, it probably will be done by the Government, because it seems inconceivable that it could be done in any other way, without creating friction among the various agricultural and business factions.

The problem of clearing a certain area of clouds, providing they are not too thick, can even be accomplished today, but admittedly, at a terrific cost. In the United States this has already been accomplished on an experimental scale, where electrified sand has been discharged by airplanes in a cloud section, and it was a simple matter to clear a small area, or to make a hole in the clouds, by scattering such electrified sand. Of course, in the ultimate scheme, such a system would not be used. It is conceivable, that small metallic captive balloons stationed at intervals around a large city could be kept aloft at practically all times, and it would be the mission of these balloons, by electrical means, to prevent clouds and thus rain from forming over the protected area. For one thing, this would be a more or less practical scheme, for the reason that rain clouds rarely go above a thousand-foot altitude. This, however, would not mean sunshine, because other and lighter clouds of the non-rain variety go much higher and it might not be possible to send balloons to such heights in order to clear *all* types of clouds. Such a scheme would seem to involve an exceedingly high cost, but when one comes to think of it how much even a single rainy day represents to business men of a large city, such as New York or London, the cost of clearing the atmosphere and preventing rain would really become trifling. I am certain, that if the business world of a large city were asked to pay a reasonable contribution every year to maintain artificial weather control of this sort, the vote would be overwhelmingly in favor of such an installation, even if it were to cost twenty-five million dollars a year to maintain. Even at such a figure, it would be cheap.

I admit that proposals of this kind are no cure-all. For instance, the electrified balloons would be of no use at all in a severe atmospheric disturbance, such as a tropical hurricane or tornado-like wind storm, but these are more or less exceptional and would have to be taken with a good grace. The point I wish to make clear, is that weather, within a reasonable degree, can be controlled, if we are willing to pay the price.

Of course, it is not only rain that is universally hated by a big city. More important than rain prevention, is the doing away with snow. In a large city like New York, a single snowfall costs the city a million dollars in snow removal alone, not to mention the many other millions of dollars that it costs the community, the business people, as well as the loss of time which is occasioned when vehicles no longer can move. It has been estimated that a good-sized snowstorm, in its final analysis, in the City of New York, costs anywhere from ten million dollars up, if all the consequences are considered, which they must be. And there are anywhere from a dozen good sized snowfalls upwards in New York each and every winter, while in large cities further North, such as for instance, Buffalo, Cleveland and Chicago, the cost is proportionately much higher because the snowstorms are more severe than in New York.

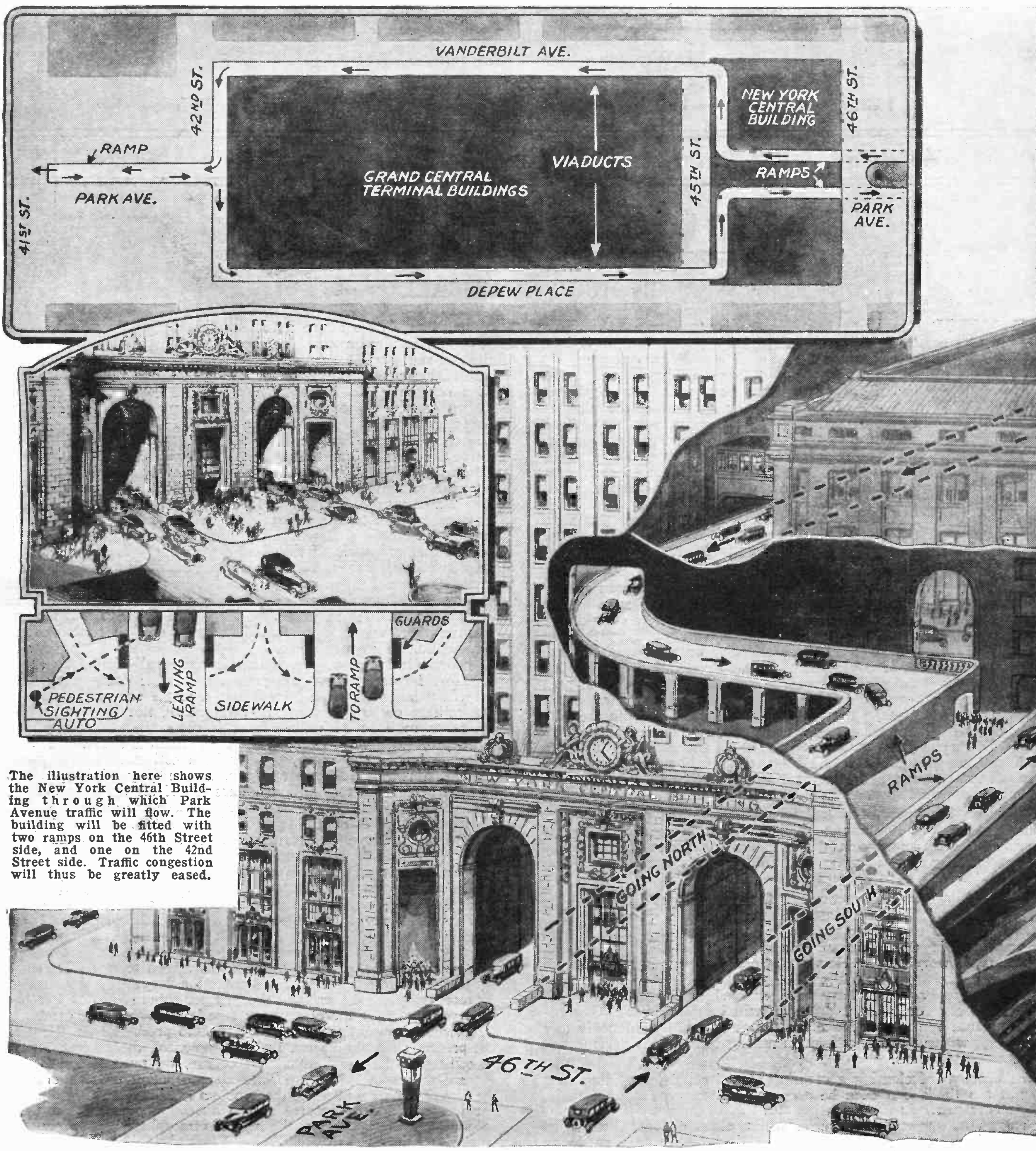
While so far, the progress made in producing rain by electrical methods has not been great, many proposals have been made, but it would seem that for some years to come, nothing practical will be evolved in this direction. No matter what system is used, it would be apt to be most expensive, far more expensive as a matter of fact, than an agricultural section could afford to pay. It is one thing to put an electrical barrage around a large city, because so many more people live there and the cost per square yard of weather control per capita is therefore very small. But when it comes to this service for an entire countryside, just to produce rain, the cost at the present time, with what little is known of the subject, would seem offhand to be prohibitive. Of course, we must never forget, that some means of which we have no conception may be created in the future, which will make the problem rather simple of solution.

For instance, I can conceive of the liberation of a huge amount of a slow-moving gas into the upper atmosphere, which ignited by rockets or otherwise, would give a sufficient effect to create a downpour, by reason of the sudden expansion and ensuing contraction of the air. You must have moisture in the air before you can have rain. And, it is simply a matter of getting enough evaporation, one way or another. It is therefore, not inconceivable that some chemical plan can in time be evolved, which could solve this problem at a cost that, even for a large area, would not be prohibitive. At any rate, this interesting problem is not impossible of solution.

Mr. Hugo Gernsback speaks every Tuesday at 9.30 P. M. from Station WRNY on various scientific and radio subjects.

# Street Traffic Will Flow

## New York Building to span thor




**The illustration here shows the New York Central Building through which Park Avenue traffic will flow. The building will be fitted with two ramps on the 46th Street side, and one on the 42nd Street side. Traffic congestion will thus be greatly eased.**

NEW YORK'S most remarkable and interesting skyscraper will be the New York Central Building, which will stand squarely in the middle of Park Avenue, with its huge tower higher than the Washington Monument, 560 feet above the street. The building is anchored with steel piles, sunk in solid rock, fifty feet below the pavement. These pass through two levels of railroad tracks. It seems incredible that through the building itself will pass all the automobile and pedestrian traffic that now goes up and down Park Avenue. Furthermore, the traffic across 45th Street will flow beneath the north and south bound Park Avenue traffic, a feat only made possible by a most novel system of ramps and viaducts placed as shown in the illustration. The main lobby of the building, located between the ramps, carrying the new elevated roadways, will be 20 feet wide and 40 feet high, extending from 45th to 46th Streets. A bridge across Depew Place, at the 15th floor of the new building will connect with the old building where the present offices of the railroad are located. Attractive arcades, passing through the building, will be provided for pedestrians as a continuation of the Park Avenue sidewalks. The ramps will extend entirely through the building, isolated from the lobby.

# Through City Skyscraper

**oughfare with rail tracks below**


**At the right is an illustration showing how the 35 story skyscraper will look when completed. This huge office structure, 560 feet high, will span the traffic thoroughfare with rail tracks below. The situation of the traffic ramps and railroad trains is shown in the large illustration. The building is now under construction on the blocks surrounded by 45th and 46th Streets, Vanderbilt Avenue, and Depew Place.**

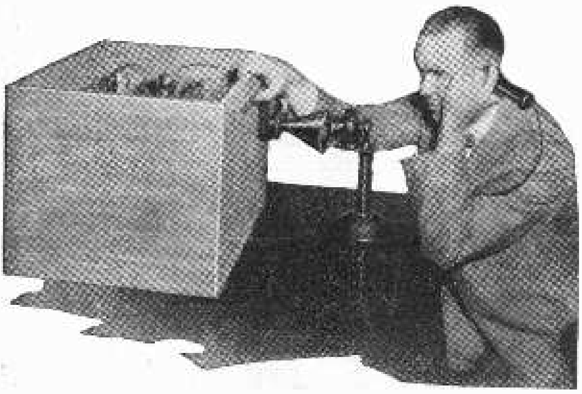
This improvement will be of vast importance to the traffic on Park Avenue and will eliminate congestion at the north end of the Grand Central Terminal, by the opening of Depew Place. A raised roadway is being built on Depew Place between the Hotel Commodore and the Grand Central Terminal, corresponding to the one already on its western side, so that traffic will flow around both sides. Where the two streams meet at the northern end of the station, a viaduct will be built along and over 45th Street. The northern incline will occupy the block between 45th and 46th Streets, running into the center of the viaducts. The southern incline will extend a block or more on either side of the station, thus there will be a space for the continuous flow of north and southbound traffic. Construction work has already commenced and the building program has been laid out so as to cause the least possible interference with the present street traffic. The roof and tower of the new building is to be illuminated at night and will provide an additional aerial landmark for New York City. The exterior of the building will be of Indiana limestone for the first four stories with exterior brick walls above. The architectural motif is to be along strictly classical lines with decorative features subordinating.

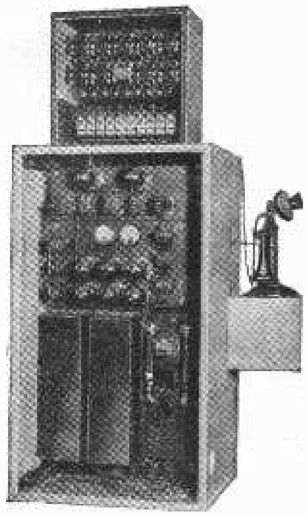
# Has the Automaton Arrived?

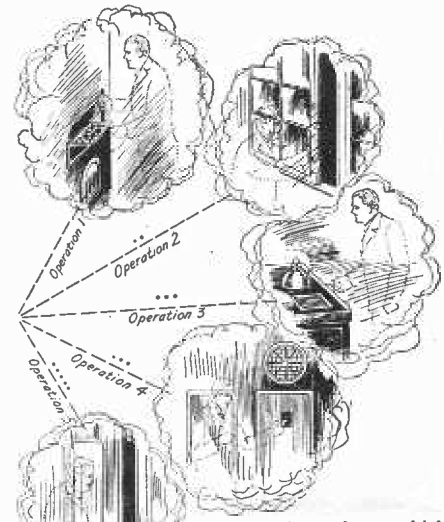
By H. WINFIELD SECOR

Subject of a radio talk given by the author from WRNY, November 22, 1927.

**The three pictures herewith spread across the page show consecutively the inventor of the Televox at the transmitter control; the receiving relay and switching cabinet of the Televox, and thirdly, we see the half dozen operations which can be carried out one after the other or in any desired order by transmitting certain sounds over any telephone line.**








**Some of the chores which the Televox will perform are shown above.**

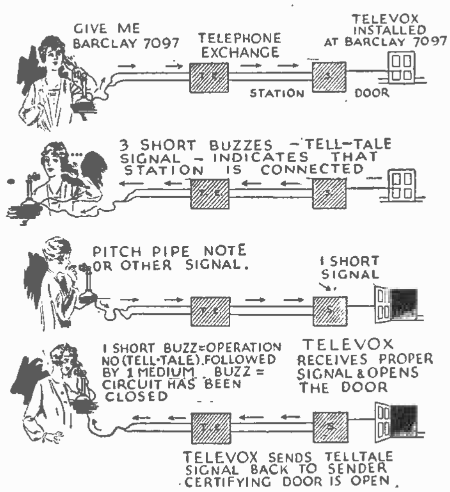
RECENTLY the writer of this article was invited to a demonstration of the newest wonder in electro-mechanics, known as the Televox. In a few words, this quite remarkable instrument is a combination of almost human electrical relays and selector switches, which respond accurately to sound signals of different pitches. This electrical Robot was devised by Mr. R. J. Wensley, of the Westinghouse staff of engineers.

The Televox was devised primarily for the purpose of starting and stopping electrical motors and generators in electric substations, and if Mr. Televox can operate the machinery in a sub-station, why hire men to do the work? At the demonstration of this uncanny automaton, a vision of what the future holds in store for us was obtained.

Mr. Wensley explained—"It is against the rule of the telephone companies to connect extraneous wiring to the telephone apparatus or to transmit over its lines anything except sounds within the register of the human voice. Hence, to utilize the telephone for controlling machinery, these regulations have to be observed. The problem was solved by using a series of sound-sensitive relays to make the switching connections at the control end, and operating these relays by telephoning to them different combinations of musical notes.

"It is theoretically possible to construct sound-sensitive relays that will respond to spoken words," continued Mr. Wensley, "and we have at our East Pittsburgh laboratories a door which will open only to the call of 'Open, sesame!' and to no other combination of sounds. However, such a system would be highly complicated to work out in practice, whereas by the use of only three notes of different pitches, we can secure any combination of operations desired."

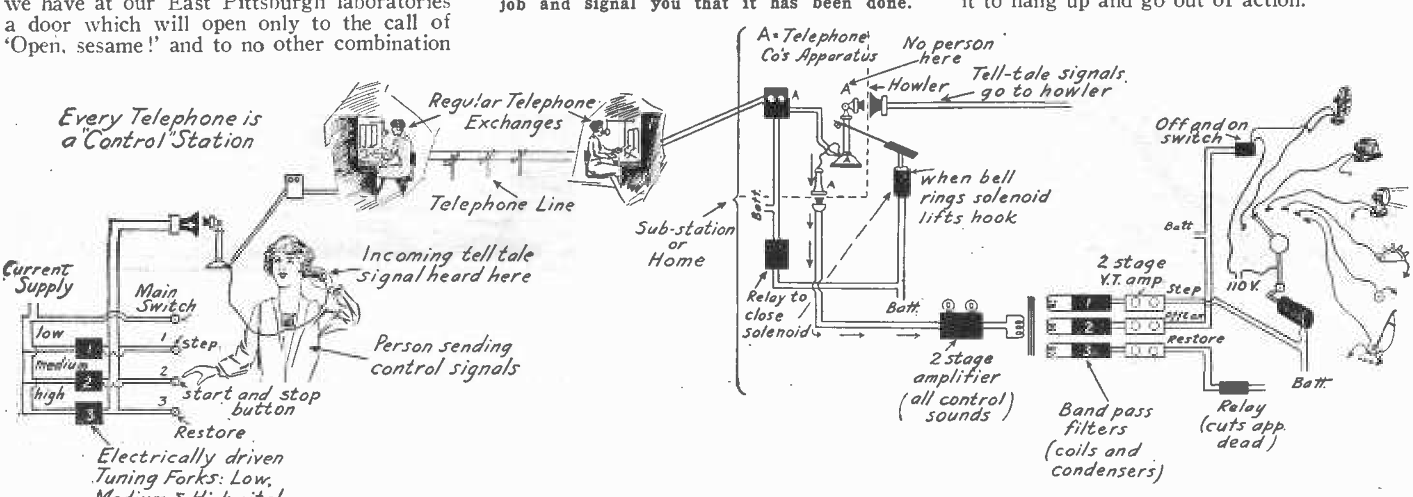
Sounds that come over the telephone to the televox apparatus are picked up from the receiver by a sensitive microphone and amplified. The tell-tale buzzing signals made




**The diagram above gives a clear idea of the operation of the Televox, the newest electrical handy-man which will do any kind of a job and signal you that it has been done.**

by the Televox are given out by a loud speaker close to the telephone transmitter. Hence, no electrical connections to the telephone are needed, and nothing but sound is received from it or given to it. When the bell rings, a sound-sensitive relay lifts the telephone hook, starts up the station-signal buzzer, and sets the whole apparatus ready for action. By means of a high note (from pitch pipe, etc., produced at the demonstration by an electrically-operated tuning fork) any desired one of any desired number of relays is brought into play. By sounding the note twice, relay No. 2 is connected; by sounding the note three times, relay No. 3 is connected; and so on indefinitely. The operator must, of course, know his relays, and call for the particular one desired.

The Televox apparatus sends a certain characteristic signal back to the control station phone, apprising the operator of the fact that the operation has been completed. When the Televox apparatus is called, it repeats its code number of say, three buzzes, for about a minute and will then automatically hang up, unless you give it some order by means of one of the special tone signals. Once Televox is given an order it will keep the circuit open until it receives a proper tone signal to close the circuit, or until it receives a "restore" signal, which will cause it to hang up and go out of action.

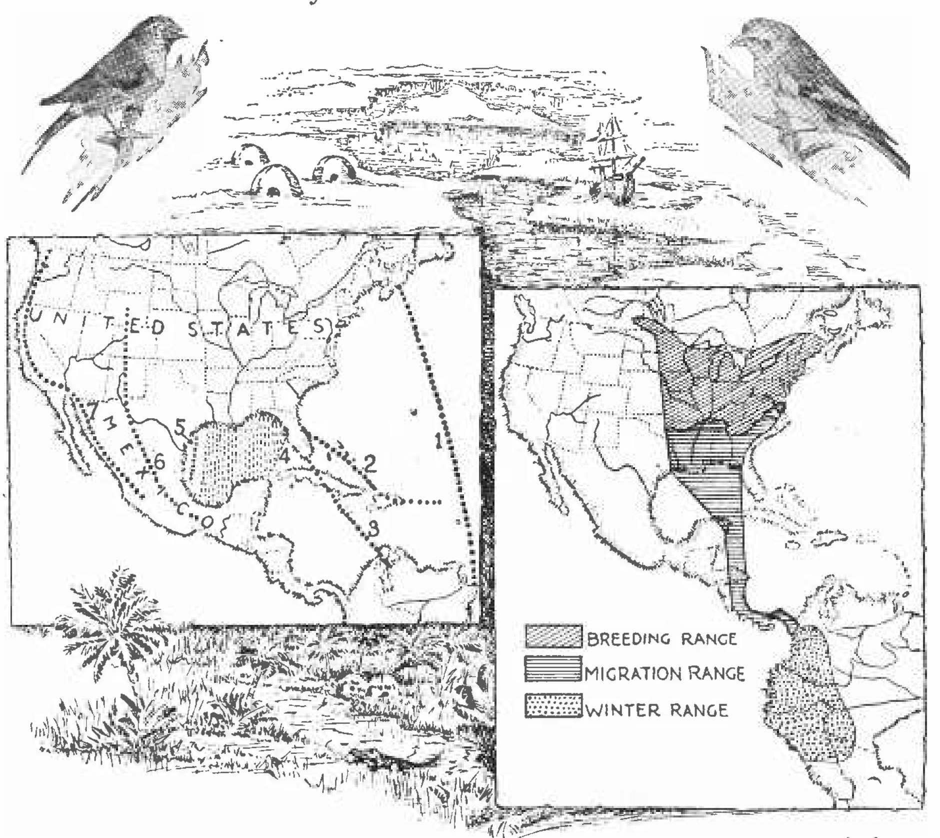



**The diagram reproduced above gives a comprehensive idea as to the electrical circuits employed for sending orders over the Televox circuit. Each tone signal is passed through a filter circut and then amplified still further before actuating a start and stop relay, selector switch, etc.**

# Why Birds Migrate

*By* DR. ERNEST BADE

THE bird is a creature of the air, wind and inclement weather seem to have but little influence upon its capabilities of flight. As long as the bird remains upon the earth or upon the branch of the tree it feels the effects of the wind, but when it spreads its wings in flight, conditions are different. Here it turns into the wind's eye and either lets itself be carried, with outspread wing, by the wind, or it flies, with the aid of muscle power, in any direction it cares to go. Here two factors must be considered. The first, when going with the wind, muscle power is exerted and the speed attained is equal to the velocity of the wind plus the speed attained by the bird, second, in flying against the wind muscle power is the prime factor.



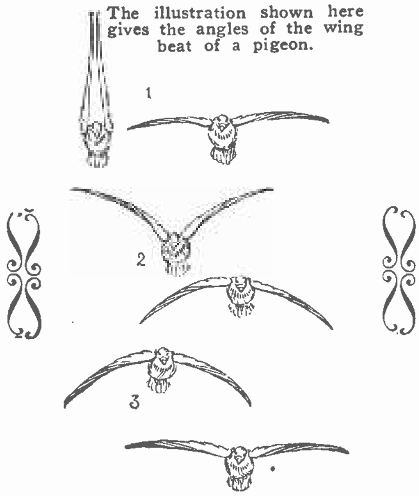

At the left is a drawing showing the principal routes taken by birds in their migrations between North and South America. The routes are numbered from the east, westward, the middle one No. 4 being the most important. The narrowness of the migration range, as compared with the summer and winter ranges may also be seen. The different courses taken by birds to get around or over the inhospitable regions are almost as numerous as the bird families which traverse them. *Courtesy Nat'l Geo. Mag.*

Before the time of migration and just after the nesting period the time of molt takes place. This usually occurs once a year although in some cases twice a year. Here almost all of the feathers are lost and the most peculiar thing about it all is that the feathers are lost in regular order; in wing and tail, they are lost in pairs. When a feather is lost of the right wing, then a similar feather is lost from the left wing. The second pair of feathers is lost when the first new pair have practically completed their growth. Therefore the bird does not lose its power of flight. Only a few birds whose period of molt is of short duration are excepted. Here all the feathers are lost in a comparatively short time and they are unable to fly. This is the case with geese and ducks and when they are molting, they seek shelter in hiding places.

After the molt the majority of birds begin to travel. It is the period of migration, the fall of the year, the food supply is still plentiful, many insects are still buzzing around the trees and shrubs, while the fruit bearing trees are loaded. But the bird is consumed with restlessness and with an inner fire, an urge that will not be denied.

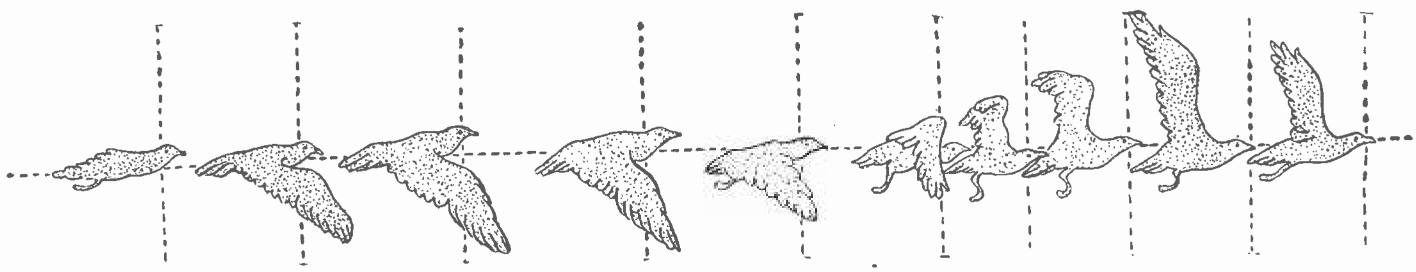
Some birds travel as individuals, others in small groups, still others congregate in large flocks. While on their way they rest but little and often reach their destination dead tired and completely exhausted. There are still other birds which are real wanderers and the causes that may help to spread the home of any bird are many indeed. The cutting down of forests, laying out streets, railroads, etc., aid in the further distribution of birds. It is in this way that the English sparrow has circled the globe, and has even penetrated the frozen north following the Cossacks in Siberia, where their horses provided the birds with food.

The illustration shown here gives the angles of the wing beat of a pigeon.




Although it is true that the urge to migrate has been handed down through countless generations of birds until it is an instinctive action today, it does violate the best interests of the birds. The food supply may be ample throughout the year and still they seek new homes, the breeding season may be slightly delayed and the young must be fed, but the urge to migrate causes them to leave their young behind to die of starvation, the young brood which is still helpless.

This wanderlust was undoubtedly brought about by violent climatic conditions in the early ages of bird life. At that time the face of the earth was far different than it is today. It was not a flowering garden as now but great expanses of water, wastes, impenetrable forests and large fields of ice. The food problem for birds was a difficult one to solve. There was no place where the bird could obtain food for any length of time in any comparatively small area of ground, as is the case today with quite a few types of birds which feel quite at home in certain regions. At that time it was not sufficient for the bird to make a leisurely flight to new feeding grounds when the food became scarce in its home site. It had to make enormous flights and life, which was a real battle for existence, consisted of continual



**The various positions of the wing and body of a sea gull during flight is shown in the above illustration.**

(*Continued on page* 859)

# The "Fingerprints" that Guns Leave

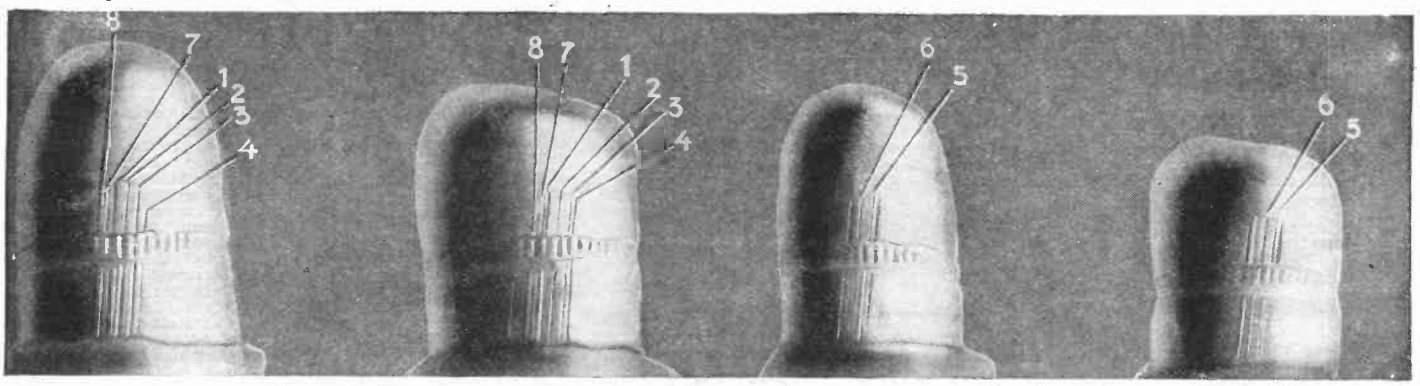
## Bullet and Shell Identification

*By* PHIL. M. RICHARDSON

*Private Investigator*

The difference in the striking place on the primer of two shells.

Compare this photo with the one at the left. The shells are identical.



The bullet at the right was taken from the body of a murdered Prohibition agent. The bullet at the left was fired from the suspect's gun. The numbered lines show points of likeness, proving the suspect guilty of murder.

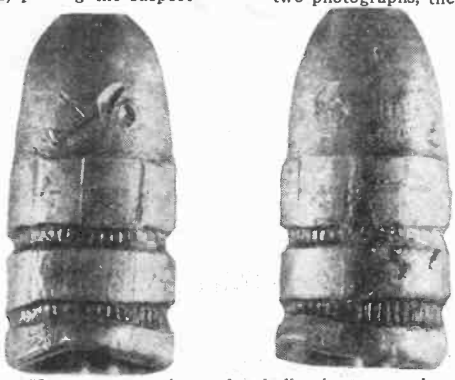
Here is a different view of the photographs at the left showing additional points of identification of the same bullets. By the aid of these two photographs, the evidence in the hands of the police was absolutely conclusive.

THE idea of identifying guns by bullets and shells is as accurate and certain as identifying a man by his fingerprints.

Even if no weapon is available for examination, a study of the recovered bullet will reveal the calibre and make of arm which fired it and enable the police to center their efforts upon locating a weapon of this make.

The fired bullet carries two separate and distinct "gun prints" neither of which can be duplicated. The first is left by the grooves of the barrel which are never duplicated in any two arms even of the same make and models. There will be variations of a few thousandths of an inch from groove to groove in the barrel.

The second print is left by minute irregularities in the surface of the gun bore, each of which engraves its mark on the soft face of the bullet passing along it.



Here are two views of a bullet in a recently perpetrated Tong murder. What appeared to be a Chinese character may be seen at the top of the bullet.

The more a barrel is used the more irregularities it develops in the form of rust spots and lumps of metal-fouling, readily visible and leaving noticeable marks on the bullet.

As no two makers ever employ the same rifling specifications throughout, it is possible, by careful microscopic measurements of a fired bullet and by comparing these with the standards recorded, to eliminate, one by one, all makes of arms except the one through which it was actually fired. A useful table follows at the end of this article.

The shell that is left also plays its part. It carries three and sometimes four distinct and separate "prints" by which it may later

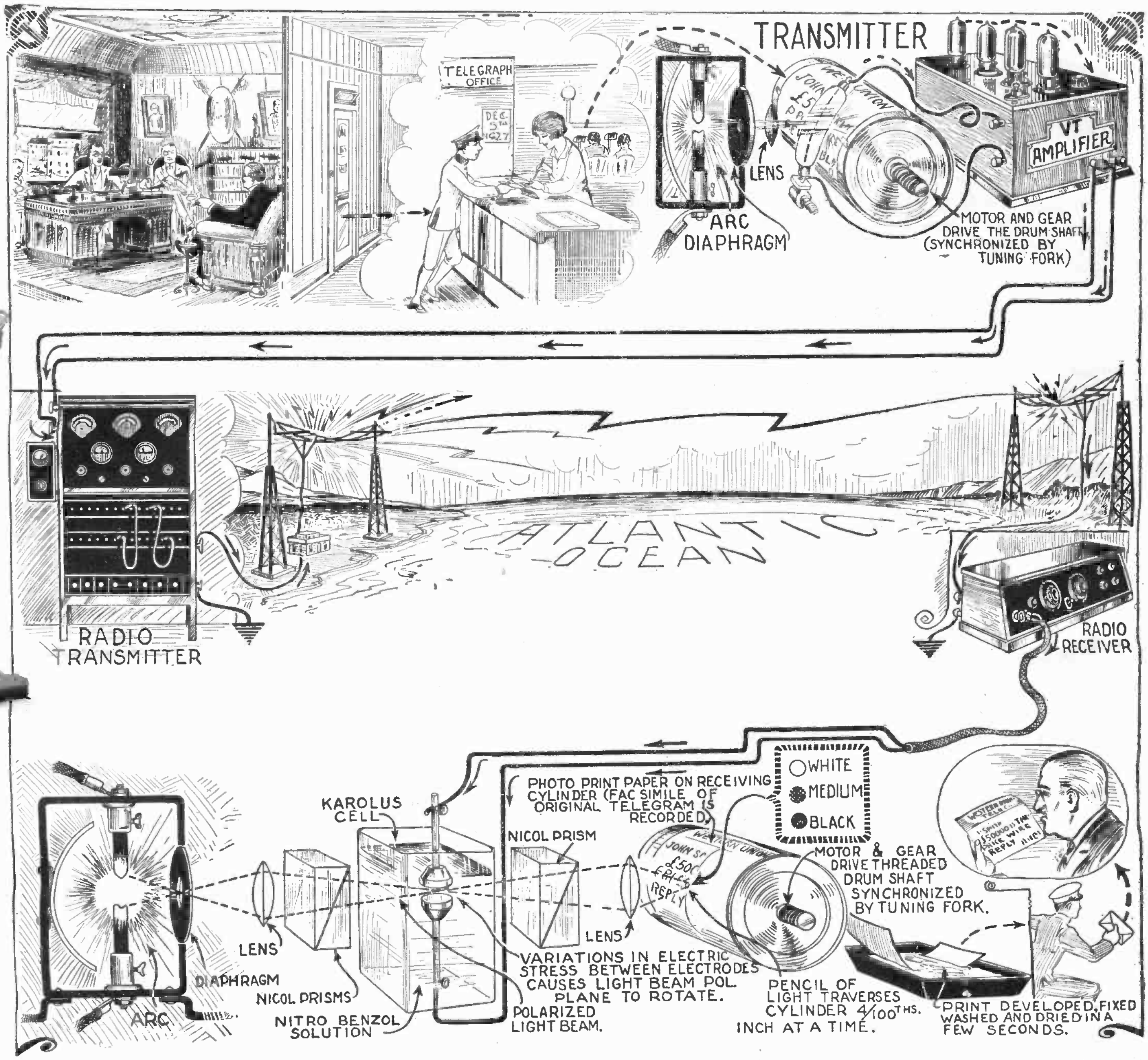
(*Continued on page* 861)

Here is a magnified view of the mark of the ejector of a Colt 45. The arrow points to the mark.

In this case the suspected person was killed before he could even be brought to trial on the attempted murder charge.

# Telephoto Sent In Record Time

## Photo Message Can Be Sent In Thirty Seconds With New Inventioı

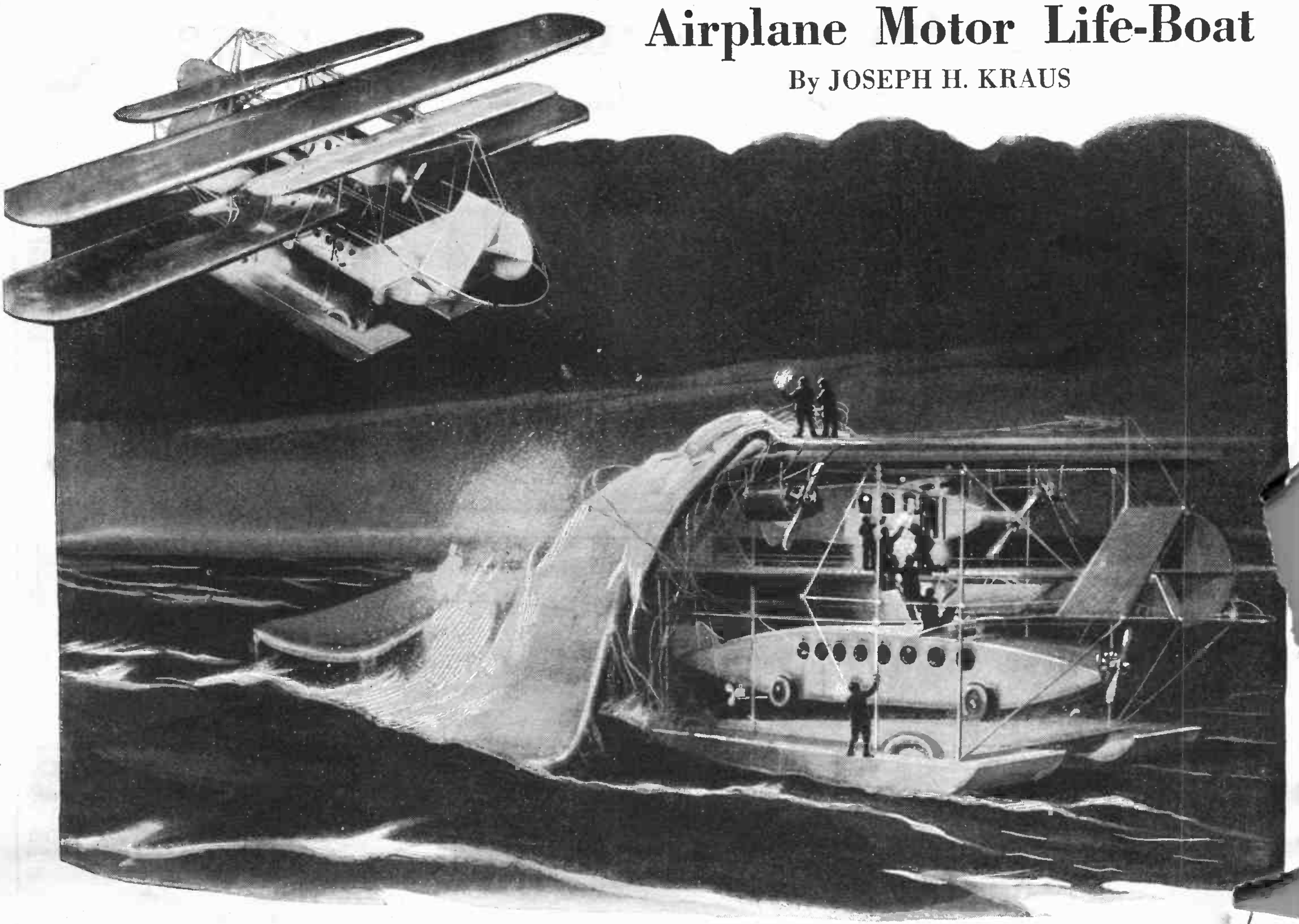



**Above we have a combination picture drawing and diagram showing, step by step, the method taken in sending a message across the ocean. The message sent out from ordinary radio transmitter in the United States, crosses the ocean, and is received, all in 30 seconds.**

THE development of a telephotographic system invented by Prof. Karolus has been so rapid that the Telefunken Co. in Germany predicts that within the next eight months that telegrams will be sent as photographs instead of dots and dashes. In the laboratory of the Telefunken Company, it was proved that it is now possible to transmit and receive an ordinary telegram in thirty seconds, which is thus far the highest speed ever achieved in telephotography, being 1-16 the time taken at present. The heart of the apparatus and its high speed and efficiency depend upon the Karolus photo-electric cell, an invention of Prof. Karolus of Leipzig. This cell is only used in the receiving apparatus, the transmitting set using the usual alkali cell, which has been made extremely sensitive to small amounts of light. The Karolus cell in the receiving system is totally different. It contains nitro-benzol, which is doubly refracting under electric tension. Beams of polarized light are focused on this cell. Polarized light is simply light which is vibrating in one plane only. Rotate the polarizing prism through a definite angle and no light is seen, but if it is rotated still further then the light again becomes visible. In the receiving set, these prisms are stationary, the new cell producing the same effect as if they were turned. When a dark spot on the photograph at the transmitting station is to be recorded the Karolus cell responds electrically to affect the polarized light beam playing upon the piece of photographic paper. The secret of the high speed obtained is due to the fact that there are no moving mechanical parts and hence no inertia to overcome. The telegram to be sent is wrapped around a cylinder at the transmitting station. A minute light beam moving from one edge to the other scans the telegram at the rate of five lines every four-hundredth of an inch. The light beam reflected by the telegram falls on the photo-electric cell. As the lines are darker or lighter the photo-electric cell causes the current to fluctuate correspondingly according to the amount of light received by it. At the receiving end these fluctuations are received by the Karolus cell and the nitro-benzol solution changes with each fluctuation, so that the polarized light beams are similarly affected. The motors driving the transmitting and receiving cylinders must be synchronized, although they are separated by hundreds of miles. In this new telephotographic system, the motors are synchronized by electrically connected tuning forks.

# Airplane Motor Life-Boat

By JOSEPH H. KRAUS

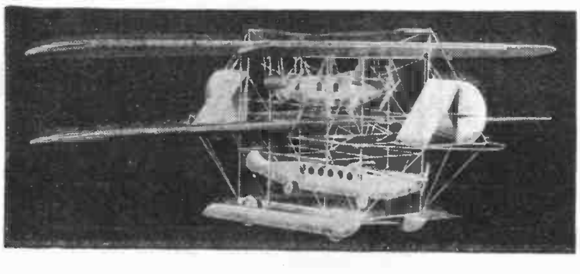


The above photo-drawing indicates an episode in future trans-oceanic flight employing the new types of aircraft indicated in the photos on this page and in our cover illustration. It will be noted that the crew, after examining the wreckage, climb down into the passenger car, which will be cut loose from the airplane, and then proceed on the remainder of its journey like any other motor-boat. Another plane is seen in flight.

EVERY day we hear of new strides being made in the field of aviation. New types of skids for the heavier planes; new constructions for the lighter planes, airplanes that are able to fly powered with but a single motorcycle engine; others which because of their high power attain phenomenal speeds.

But the trend in modern aviation is primarily based upon the factor of safety. Making airplane flights absolutely safe in any kind of weather and in any storm is the aim of modern designers. Even at the present time, aeronauts are busy with devices to prevent stalling and tail spins. Others are making aviation safer by developing ideas similar to that shown on this page.

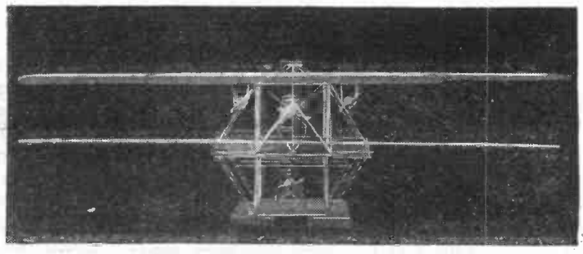
From an examination of the photographs it will be seen that the plane illustrated is an all-metal liner, having a great wing spread; giving it both a slow landing speed and exceptional lifting power. It is propelled by four motors, one of which is in the front of the pilot's cabin, two suspended from the upper wing, and the fourth, on the passenger compartment. This passenger compartment hangs from the rest of the structure, so that it is free to move (within a limited distance) in any direction. This movement will, it is the designer's intention, overcome air sickness. Inasmuch as this depending body is connected by a very simple arrangement with ailerons, it serves also to automatically stabilize the plane in very stormy weather. The pontoons are large enough to permit the plane to float and it can take off from either the surface of the water or from land, because of the automobile wheels disposed within the body of the pontoons. The wheels are lowered at will.



Here is a three-quarter view of the model, illustrating the principles of this unique aircraft construction.

In order to avoid many struts and braces, the wings of the plane are of cantilever construction and covered with metal. The pilot's cabin and the passenger coach are sufficiently cross-braced to prevent accidental damage in case of a rapid forced landing. The latter is impervious to water and, as the illustration indicates, is equipped with both wheels and submergible propeller. The reasons for the latter constructions will become apparent directly. Let us suppose that in landing on the ocean, a huge wave smashed the wing as is depicted by our artist. An examination of the wreckage indicates that there is no possibility of saving the plane, so the crew climbs down into the suspended passenger coach. Locking the hatch in place, they cut loose from the plane, dropping the coach to the platform below. Throwing the motor into gear with the automobile wheels, the 100 or 150-foot passenger coach moves off the platform and drops into the sea. From this point on, the submerged propeller takes care of the coach, which proceeds to the nearest land under its own power. In other words, the wings have been left behind and the remaining part of the airplane now becomes a motor boat.

Should the trouble occur suddenly in mid-air, it is conceivable that the passenger coach could be cut loose from the plane on its descent, as our front cover shows. The boat-like cabin could be dropped into the water before the wrecked plane even came to rest on the surface, or because of the impact, be smashed to pieces. This plane was invented by Arnold W. Genrich.



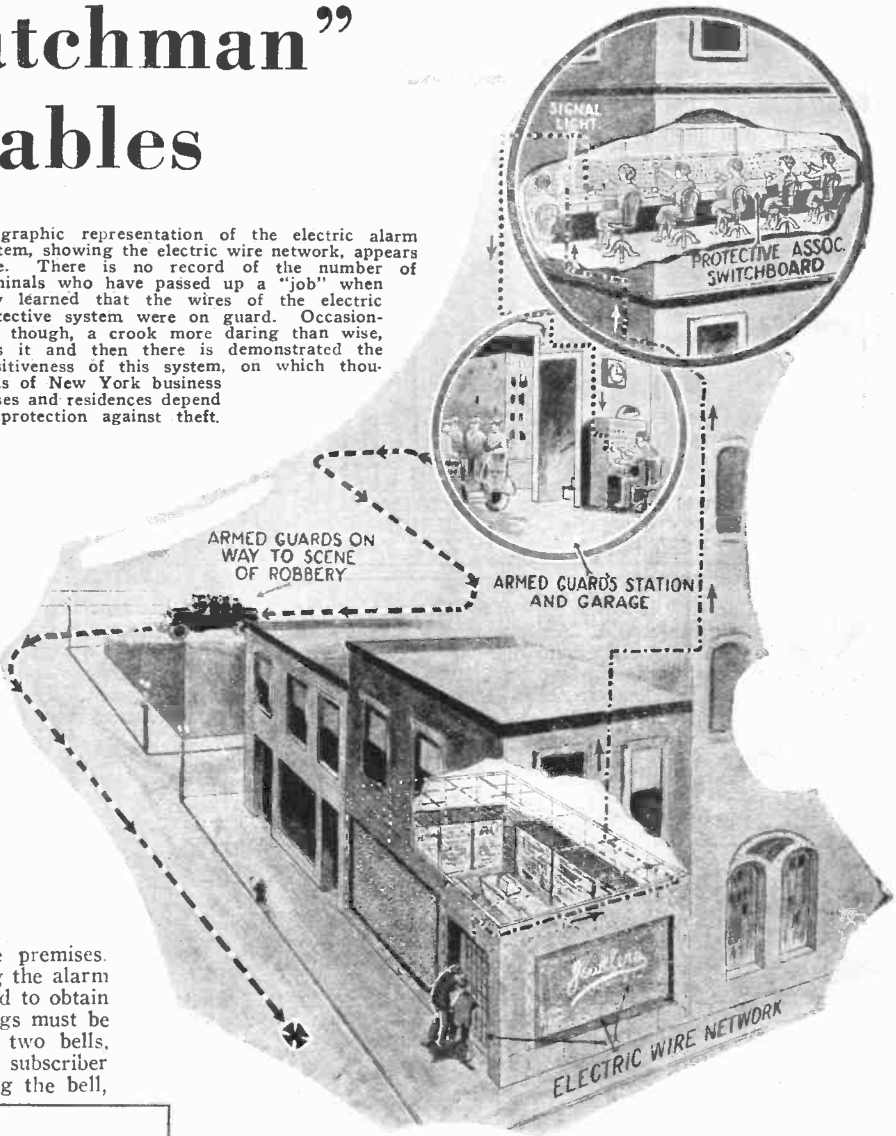
A front view of the model. The wings are not cross-braced, because their cantilever construction can support the weight of the craft.

# Electric "Watchman" Guards Valuables

THE record of captures offers convincing proof of the effectiveness of electric protection against burglars; however, the real value of this service as prevention, cannot be measured. The following description of standard operating practice will explain the opening and closing of a typical store alarm, together with the steps taken in the investigation made by armed guards upon receipt of an alarm signal.

Assume that the subscriber wants to open for business. Various designations placed on the instruments in the switchboard tell the operator many of the service details applying to this particular line, such as the character of the business, and the usual opening and closing times. When the alarm registers upon the opening of the front door, she knows whether or not it is the subscriber's usual opening time in the morning. The galvanometer needle instantly deflects to the right side of its scale and the audible and visible alarm signals are at once energized. Before the subscriber has had time to reach his set the operator has rung the bell four times, to tell him she knows he is inside and that she is waiting for his opening code signal. This must be transmitted as soon as he has thrown the switch, which sets the protection for the day period. Code signals are secretly arranged with subscribers and are for the purpose of preventing openings by unauthorized persons. After the signal has been registered and checked on the switchboard, as it is transmitted from the subscriber's set, the store is open for the day. An incorrect signal is immediately investigated by guards despatched to the premises.

The operation of closing the premises and setting the alarm for the night is simple, though in order to do so and to obtain a correct signal from the office all protected openings must be securely closed. The standard "O K" signal is two bells, which the operator transmits at once, so that the subscriber knows that everything is all right. Before ringing the bell, however, the operator works a two-way key in the shelf so as to cause the galvanometer to indicate three distinctive deflections. That is the variable resistance supervision, and gives final assurance to the operator that all equipment is properly connected. The supervisory apparatus indicates when the subscriber departs and the alarm is then immediately set for the night.



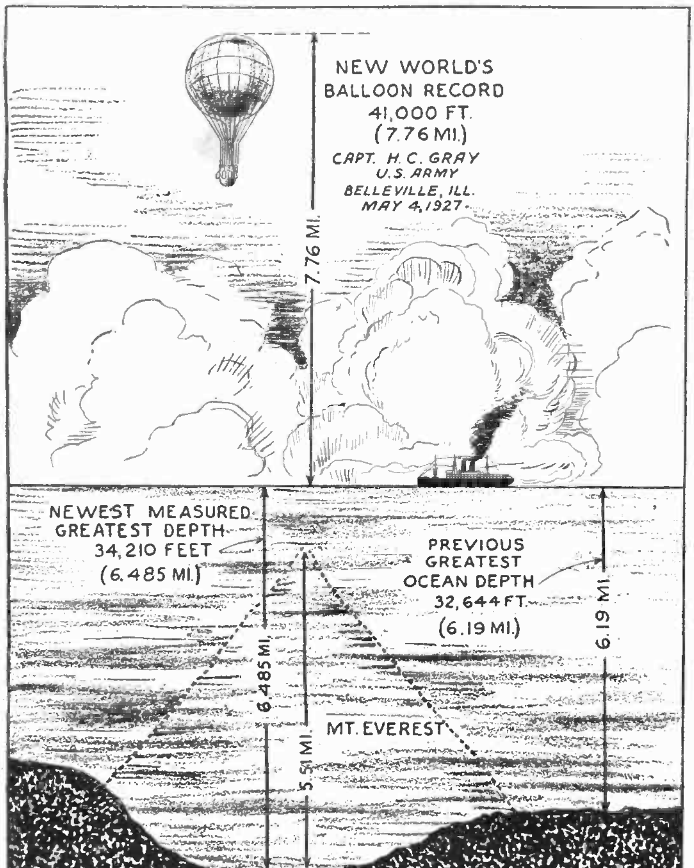

A graphic representation of the electric alarm system, showing the electric wire network, appears here. There is no record of the number of criminals who have passed up a "job" when they learned that the wires of the electric protective system were on guard. Occasionally though, a crook more daring than wise, tries it and then there is demonstrated the sensitiveness of this system, on which thousands of New York business houses and residences depend for protection against theft.

## New Altitude and Depth Records

AMERICA has apparently captured another laurel in the conquest of the air through the ascension of Capt. Hawthorne C. Gray, army aeronaut, to a height of approximately 41,000 feet or 7.76 miles. It is believed that it is the highest altitude ever attained in a free balloon and beats the old record by 5,000 feet. A specially designed aviation suit enabled the aviator to withstand the temperature of 60° below zero, while a specially designed oxygen mixer, equipped with an electric heater, provided him with ample oxygen in the rarefied atmosphere. Medical officers claimed that he had reached the limit of human endurance in rarefied air. The previous record was held by two German balloonists, who attained a height of 36,000 feet.

The deepest spot in the Pacific Ocean, 34,210 feet or 6.485 miles, has been discovered by the German cruiser "Emden", now on its way around the world. The sounding was made on a trip from Macassar, Celebes Island, to Nagasaki, Japan, but the report does not give the exact location of the enormous depth. The deepest crevice formerly known in the ocean bed, located in 1907 by the German survey ship "Planet" on the East Coast of the Philippines, was 32,644 feet. Early in the last century it was believed that the sea was nowhere deeper than about 6,562 feet.

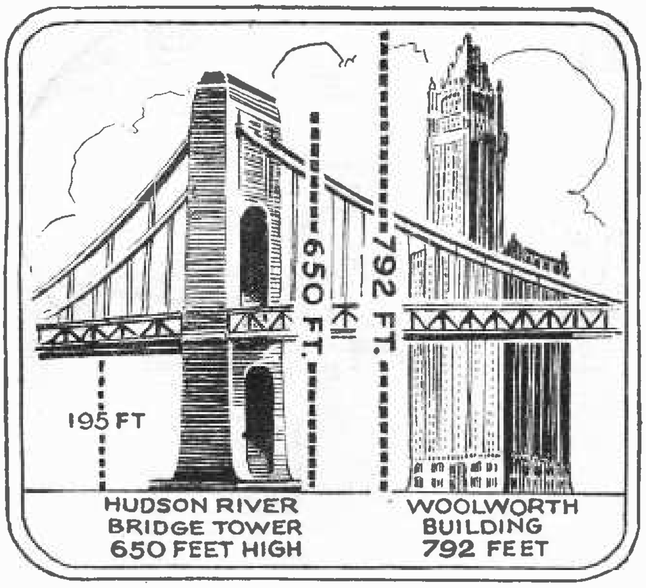
The soundings of the "Emden" were probably carried out in the so-called Japanese ditch, which runs east from Japan to the Philippine Islands. Mt. Everest, the highest peak in the Himalayas, is only 5.51 miles high and could be sunk in the Japanese ditch with ease.




At the left we have a composite drawing, showing the world altitude record, which is 7.76 miles, and the newest measured ocean depth which was found to be 6.485 miles. The previous greatest ocean depth measured was 6.19 miles. Mt. Everest, which is 5.51 miles high, could easily fit in this new ocean crevice, which is situated near Japan.

# Greatest Bridge

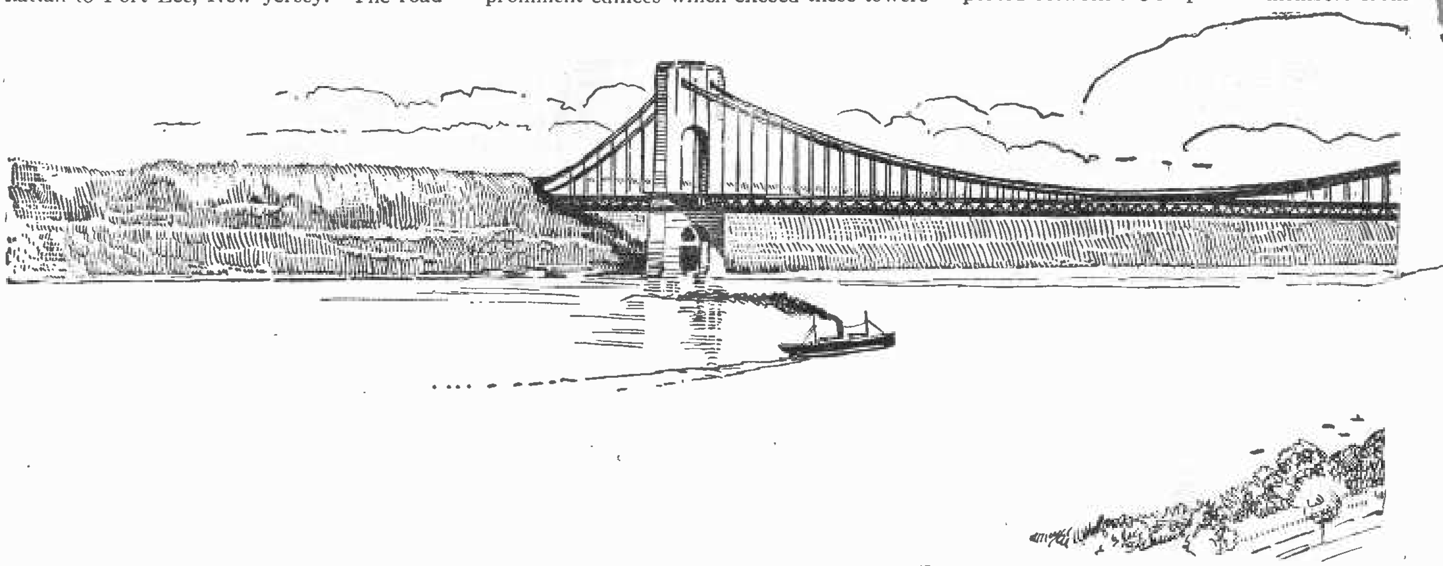
**World's largest span, connecting Manhattan with New Jersey, will be 1½ miles long and will tower 650 feet high**



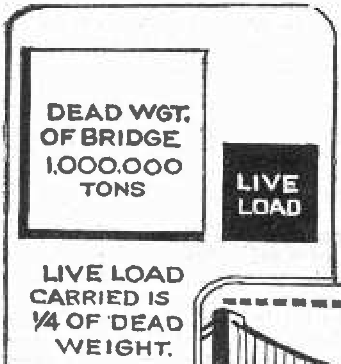

**At the left the towers of the Hudson River Bridge are compared to the Woolworth Building. The bridge is to have towers which will be 650 feet high, the Woolworth Building is 792 feet high. The bridge itself will be 195 feet above the river. The total length, including the approaches, will be 1½ miles long and the length of the main span between the two towers will be 3,500 feet. The foundations for the New Jersey towers will be sunk by the coffer-dam method.**

*Illustrations courtesy N. Y. Port Authority*

NEW York City is to have the largest bridge in the world. A huge suspension structure one and one-half miles long, with towers standing 650 feet high, is to span the Hudson River from Manhattan to Fort Lee, New Jersey. The road- the longest of bridges but so much so that it stands by itself, outside the range of comparison. The towers of the bridge are one-third higher than the Pharos and four times as high as the Colossus. The only prominent edifices which exceed these towers one-eighth as much as the pyramid of Gizeh, suspended in air, or the total weight of ten Woolworth Buildings. This huge mass of steel and masonry will be supported by four cables, each one 5,000 feet long and 36 inches in diameter made up of smaller cables about one-fifth of an inch thick. The engineers have allowed a sag of 400 feet in the 3500 foot span so that the tension on the cables might not be too great. The weight of the bridge and therefore its inertia will be so great that the force of a gust of wind would be spent before the bridge would move appreciably. The steady force of a high wind would hold the center of the bridge twelve or eighteen inches out of its normal position. A maximum swing of five feet is allowed in the design. In cold weather the contraction of the cables will raise the bridge about five feet and the two towers will move about seven inches towards the center under a load. The concrete floor of the bridge will be supported between the suspension members from

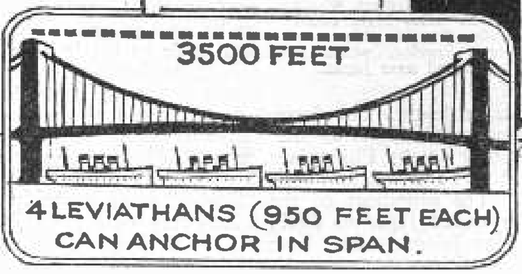


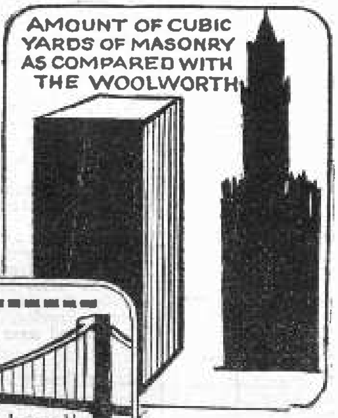
ways will be 195 feet above the river and will accommodate trains, pedestrians, and automobile traffic. The total length of the span between the two towers will be 3500 feet, the longest in the world. Estimated by its span, the Hudson Bridge is not only in height are the Woolworth, and Metropolitan Buildings in New York and the Eiffel Tower in Paris. The greatest pyramids in Egypt have an estimated weight of about 8,000,000 tons. The bridge over the Hudson will weigh 1,000,000 tons, or the cables by great steel trusses all riveted together, yet this solid structure will be sufficiently elastic to give without cracking or breaking as the bridge swings up and down, or from side to side because of the weather or the movement of traffic. The cables will be anchored on the New York side in a huge mountain of concrete and granite. On the New Jersey side tunnels will be bored more than 100 feet into the ledge of the Palisades and the cables anchored in the rock itself. Each leg of the tower will rest on a separate reenforced concrete base 90 feet by 100, resting on bed rock and faced with granite. To build these foundations the river bottom must be excavated for about 100 feet under water to reach the bed rock. New York has held the distinction of having the world's largest bridge once before. Since 1917, however, the St. Lawrence Bridge at Quebec has been the longest, with a span of 1,880 feet; however, it will be dwarfed by the new Hudson River Bridge. Two sidewalks, eight roadway lanes, and four electric railway tracks will provide communication between the two states. The bridge will be built in two stages, the first including the construction of the span and roadways, sufficient to handle the initial traffic expected; the second including the completion of the roadways and the building of four lanes of rapid transit tracks or bus lines, whichever




**Above the live and dead weight of the bridge is compared. The live load carried is one-fourth of the dead weight.**

**Four Leviathans, each one 950 feet long, could anchor in the span between the two towers. The span between these two towers is to be 3,500 feet, the largest in the world. The towers are higher than the Washington Monument.**




**The number of cubic yards of masonry which will be used in the construction of the new bridge compared to Woolworth Bldg.**

# to Span Hudson

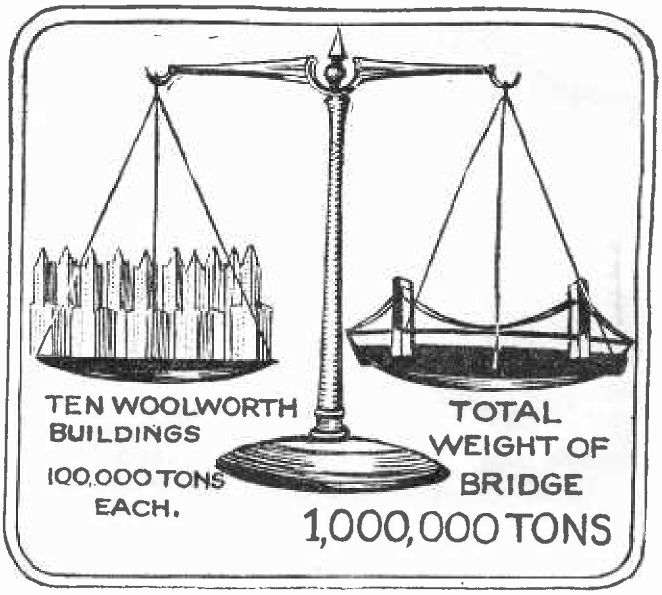
## Masonry nearly equal in volume to Woolworth Building. Wire in cables would reach from New York to Columbus, O., 750 miles

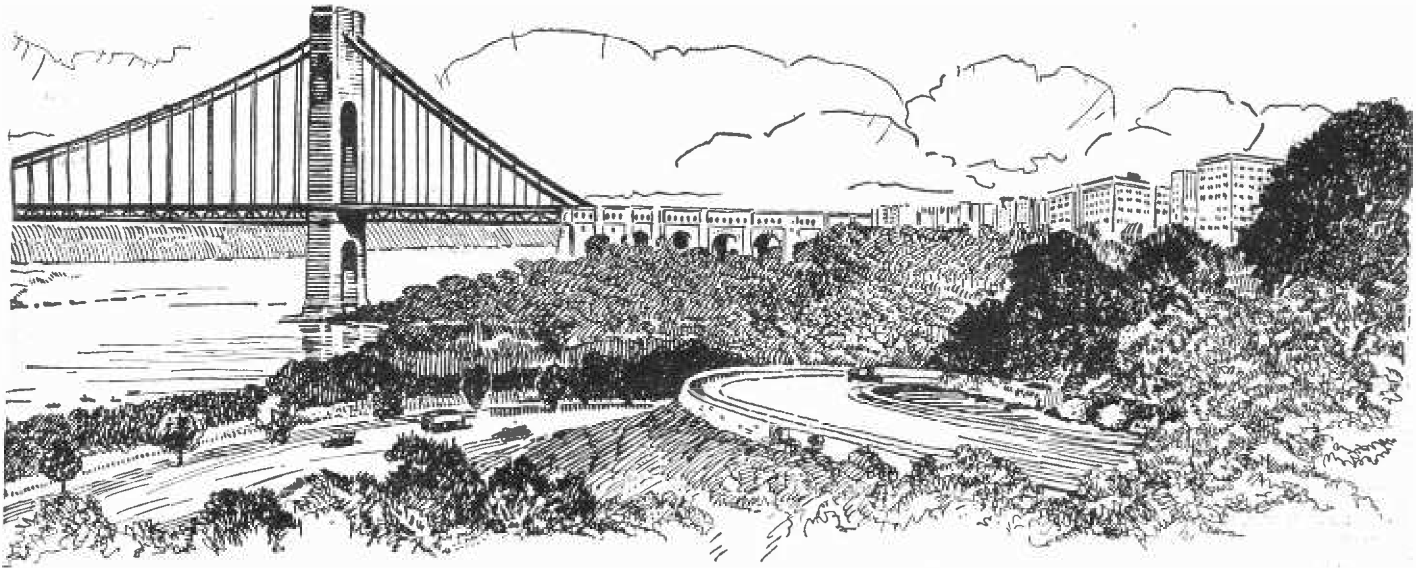
may seem expedient. The first stage will cost approximately $50,000,000, and the latter stage an additional $25,000,000, making the total estimated cost of the completed structure between $60,000,000 and $75,000,000. A work so stupendous as this in its proportions may be contrasted with the previous major achievements of mankind, both ancient and modern, in the engineering and architectural field.

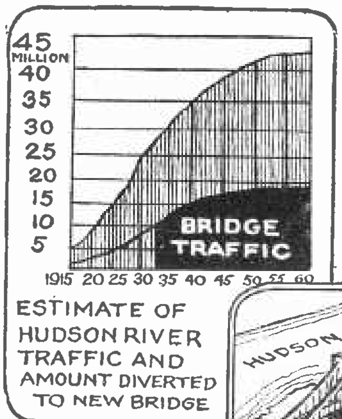
The new bridge will form the closest connection which has ever been made between the two states, New York and New Jersey; it is not expected, however, that it will supercede the ferries now in use or the vehicular tunnel, but rather to supplement and aid them in bridging the gap between the two states and further affording an outlet for the metropolitan area. It will also afford a main auto highway connection between New England and New Jersey, Pennsylvania, and the south, that will avoid to a large extent the congested districts of New York and vicinity. Traffic coming along the Lincoln Highway from the south will pass around Newark by a route soon to be constructed and will cross the bridge to Manhattan far above the congested part of the island. The Washington Bridge across the Harlem River will connect the highway with the Bronx and the Boston Post Road. The new bridge will also open a large area of New Jersey as a suburban district for New York. Traffic surveys and estimates indicate that 8,000,000 private vehicles and nearly 500,000 buses will use the bridge in the first year after it is opened. By 1960 this traffic is expected to increase to 16,000,000 pleasure vehicles and 1,600,000 buses. The theoretical capacity of the roadways of the bridge is more than 30,000,000 vehicles a year, but it is assumed that before such a volume of traffic is attained, other Hudson River crossings will have been provided.

The task of stretching the cables will not be an easy one. The initial step will be the first continuous connection through the air. By use of boats and shore winches, wire ropes are strung across the river from tower to tower. These wire ropes then become the support of a temporary working platform called a "footwalk." Great single cables are the prevailing practice when parallel wires are used, and they are "spun" a wire at a time. Parallel wire cables sufficient to bear the weight of the Hudson River Bridge will have to be thicker than the average tree trunk. These wire cables will have a carrying strength of 330,000 tons each, as compared with 125,000 tons on the Delaware River Bridge, and 45,000 on the Brooklyn Bridge. In the "spinning process" two lengths of wire are looped around a pulley hanging from an overhead travelling rope. The travelling pulley carries the two wires from shore to shore. After being trued up the wires are securely anchored at each end. Beauty has been another factor to receive attention. Cass Gilbert the architect, has added grace to the huge structure which has been worked out by Othmar H. Ammann, the bridge engineer. The proposed design calls for striking utilization of the monumental character of the two towers and approaches.

**The total weight of the new Hudson River Bridge will be approximately 1,000,000 tons, which is equal in weight to ten Woolworth Buildings, each one weighing 100,000 tons. The cables carried by the huge artificial mountain of concrete and granite will be embedded in solid rock. The construction work began on the New Jersey side with the building of a tower. The bridge is expected to be completed in 1932 and will then be opened for initial traffic.**

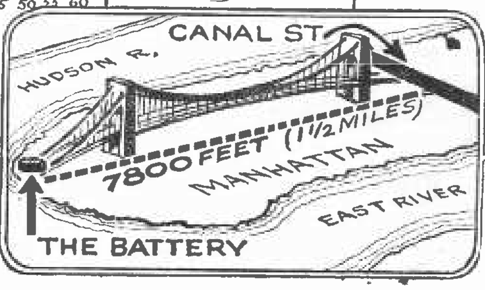


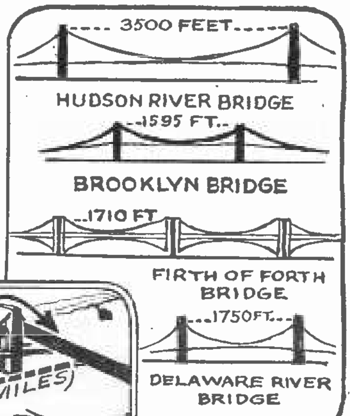






**An estimate of Hudson River traffic and the amount to be diverted to the new bridge is shown in the graph above.**

**The new bridge, which is to be one and one-half miles long, if placed upon the lower end of Manhattan Island, would reach from the Battery to Canal Street, approximately 7,800 feet, or one and one-half miles, as shown in the illustration below.**



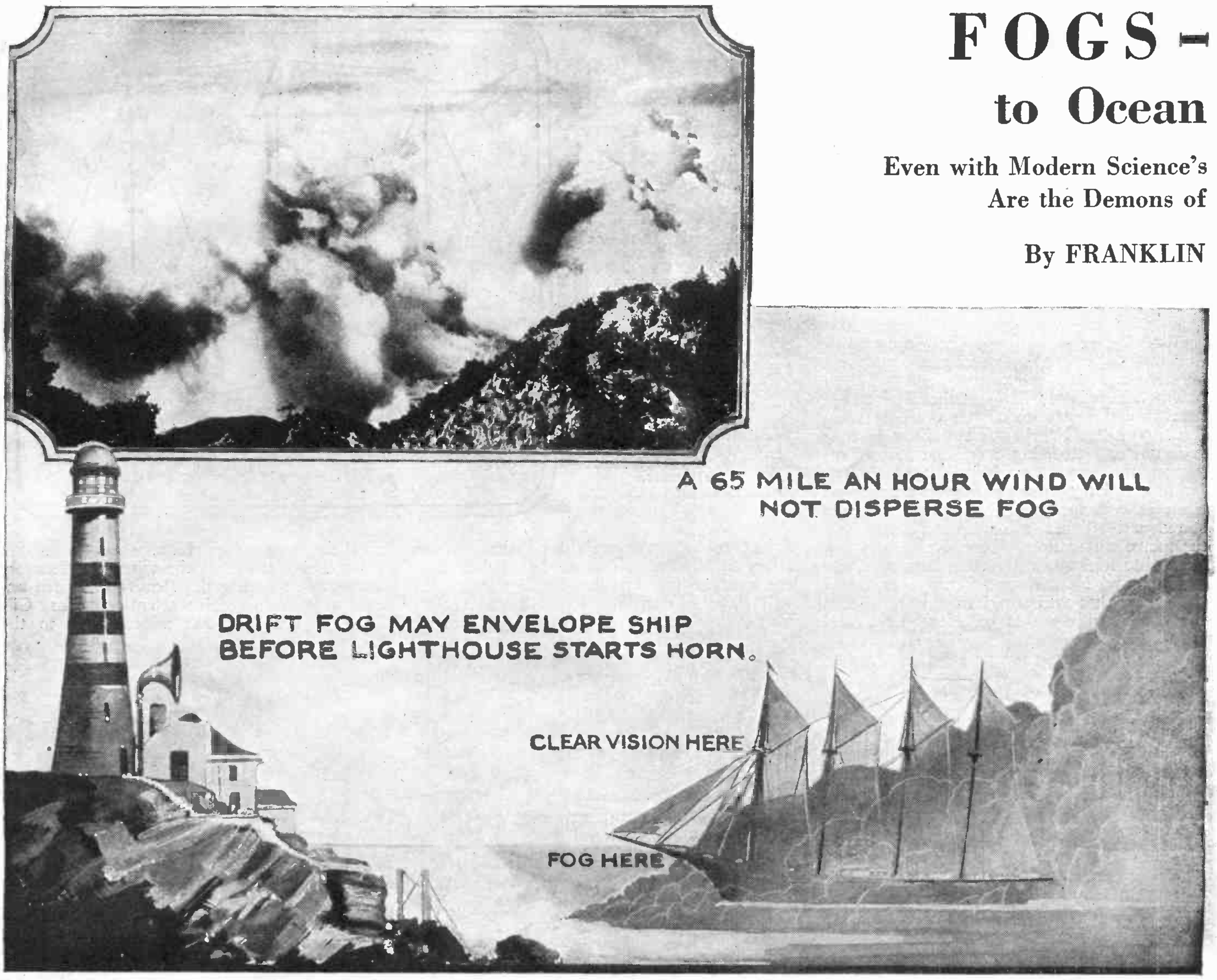




**Above, the new bridge is compared with other famous bridge spans, which will be greatly outclassed.**

# FOGS–
## to Ocean

**Even with Modern Science's**
**Are the Demons of**

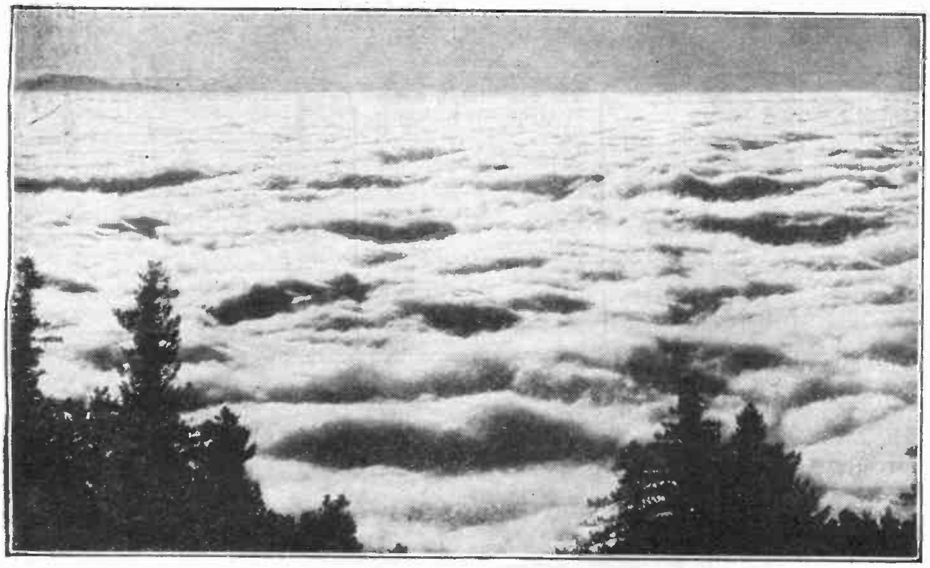
**By FRANKLIN**




**The photograph at the top shows a rare picture of a fog seen off the California coast. Notice how dense this fog is.** *Photo E. Ellerman.* **Fogs are very peculiar in both their nature and the odd things which sometimes happen. It has been frequently noted that a ship may drive into a fog belt and continue to run through this fog for hours, yet if it had veered to either side, for but a short distance, it would have been out of the foggy region.**

FOGS at sea constitute a menace to navigation, upon which all sailors look with the utmost dread. A storm is something to be met with skilled seamanship, but the fog carries a threat that produces helplessness in spite of modern methods and appliances for minimizing the danger. The peril is found in various guises, ranging from the few patches of dense fog in a thickly traveled harbor to the great fields which prevail in mid-ocean.

The possibility of fatal consequences on the high seas was brought to public attention with marked emphasis by the disaster



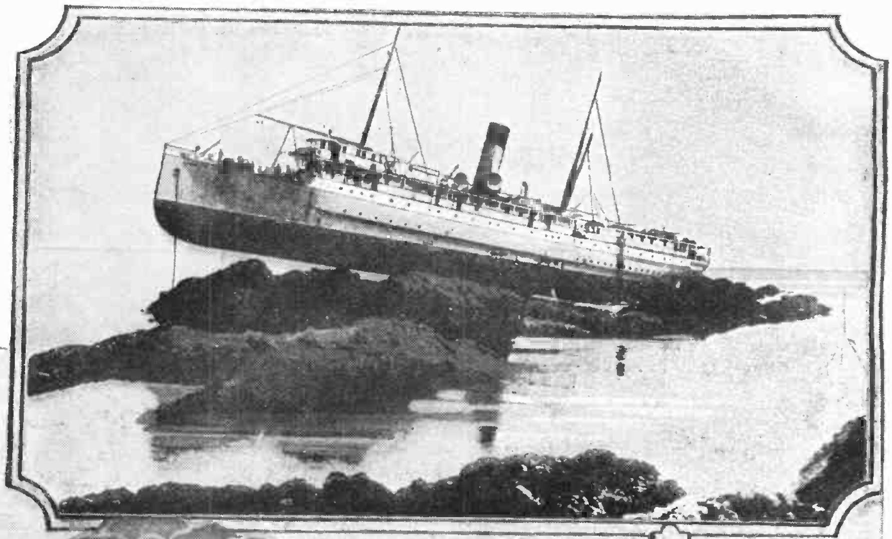
**This photo shows the appearance of a fog when looking down upon it. It was taken from a mountain top on the Pacific Coast by F. Ellerman.**

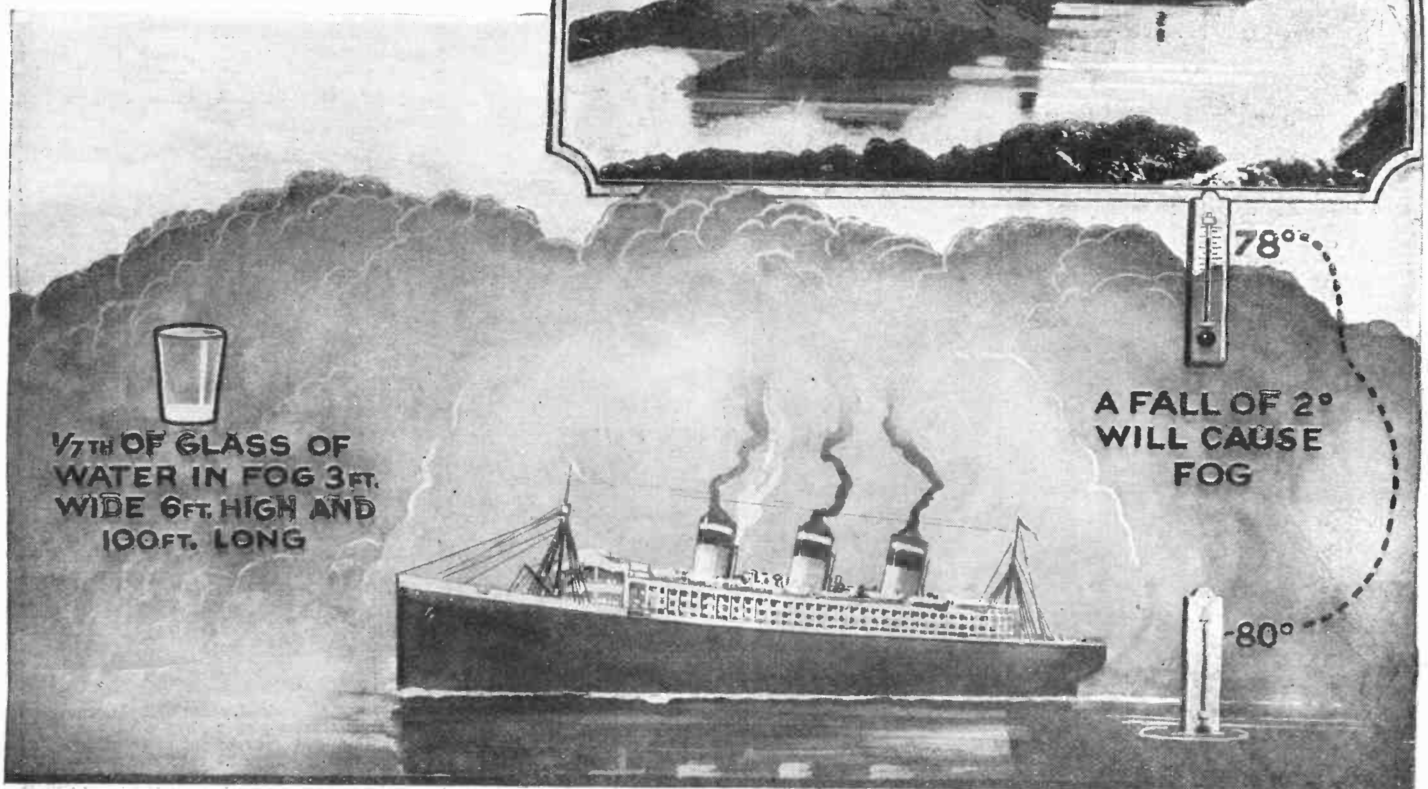
**The British steamer, "Thistlemoore," ashore at Peaked Hill Bar, Cape Cod, Mass. A dense fog was the cause of this wreck.** *U. S. Coast Guard Photo.*

# MENACE Navigation

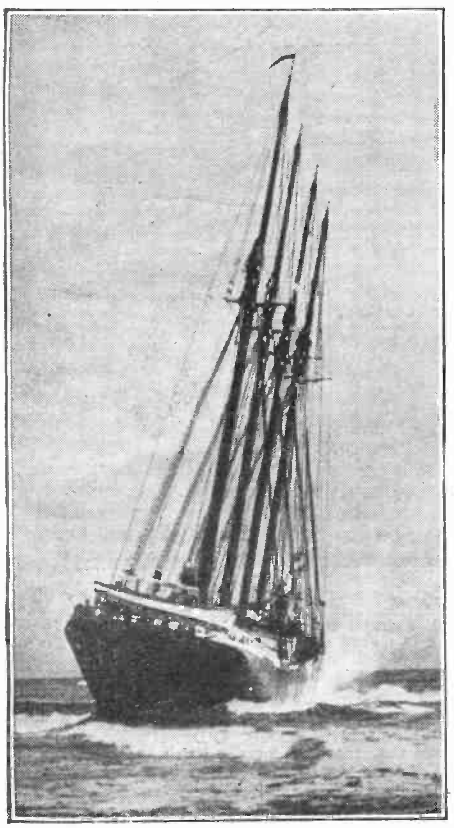
### Many Appliances Fogs Still Harbors and Seas

**JOHNSON**





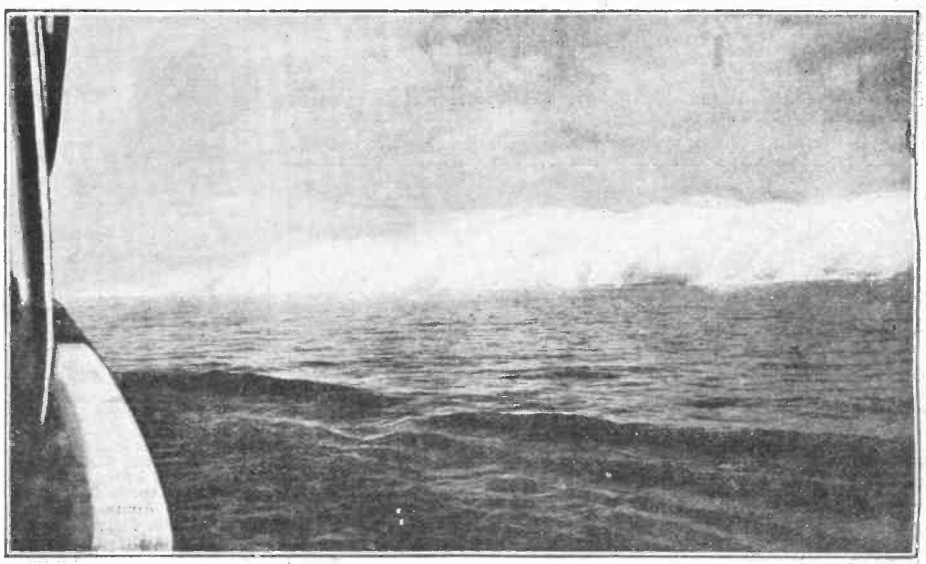

A "ghost" is that type of a fog through which sound does not seem to penetrate. A vessel in a ghost will be unable to hear fog signals on shore and the whistle of the vessel will likewise not be heard on shore. The photo at the top shows the steamer "Princess May" on the rocks off Sentinel Island, Alaska, as a result of dense fog. *Photo courtesy U. S. Coast Guard.*



of October, 1854, by a collision between the French steamer "Vesta" and the American mail ship "Arctic," in a dense fog 40 or 50 miles east of Cape Race. The "Arctic" was struck by the "Vesta" and sank, with the loss of 300 persons.

This tragedy brought about the creation of separate eastbound and westbound lanes of ocean travel between Europe and America, at the suggestion of Lieut. Matthew Fontaine Maury, U. S. N., one of the foremost students of oceanography. By providing for wide spacing between the channels, this plan

(*Continued on page* 834)



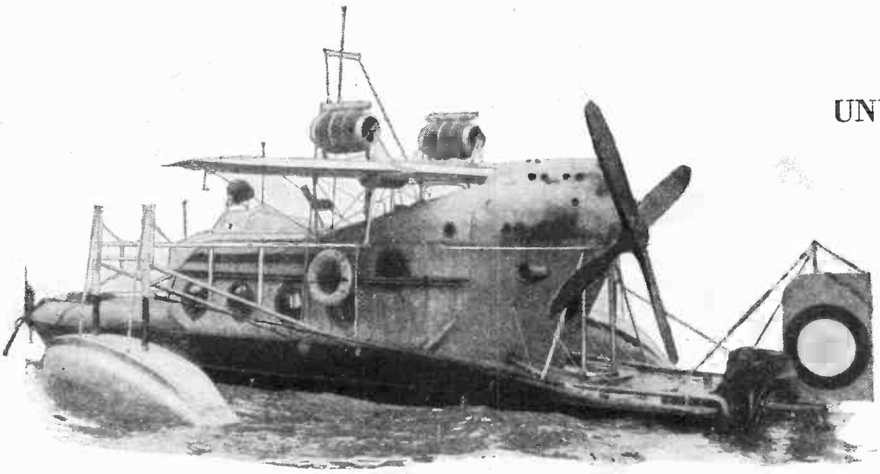
Here is an unusual incident in which two schooners went ashore near each other on the west coast of Florida during a fog. Second schooner not shown. *U. S. Coast Guard Photo.*

A fall in the atmospheric temperature of 2° will cause a dense fog such as that seen in the photo above. Photograph was taken from a ship at sea.

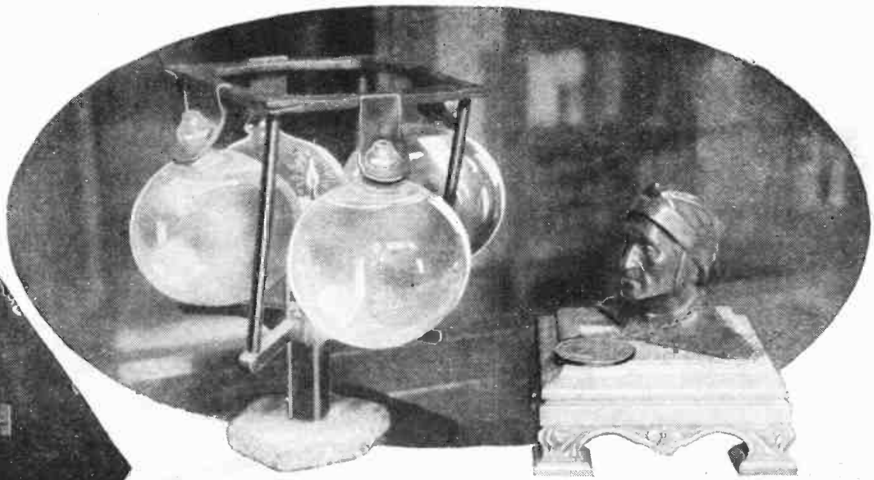
# Science In

## UNUSUAL BITS OF SCIENTIFIC NEWS

SCIENCE continues to advance, but its advances are not in any one individual or particular field. Progress is always made in all of them. The present day seems to be the era of the airplane and consequently, much more rapid strides are being made in this particular field than in many of the others. Just for contrast, we would like to have you look at the photograph on this page showing the magnifying jars for increasing the light from a candle. Then look at your incandescent bulb and mediate

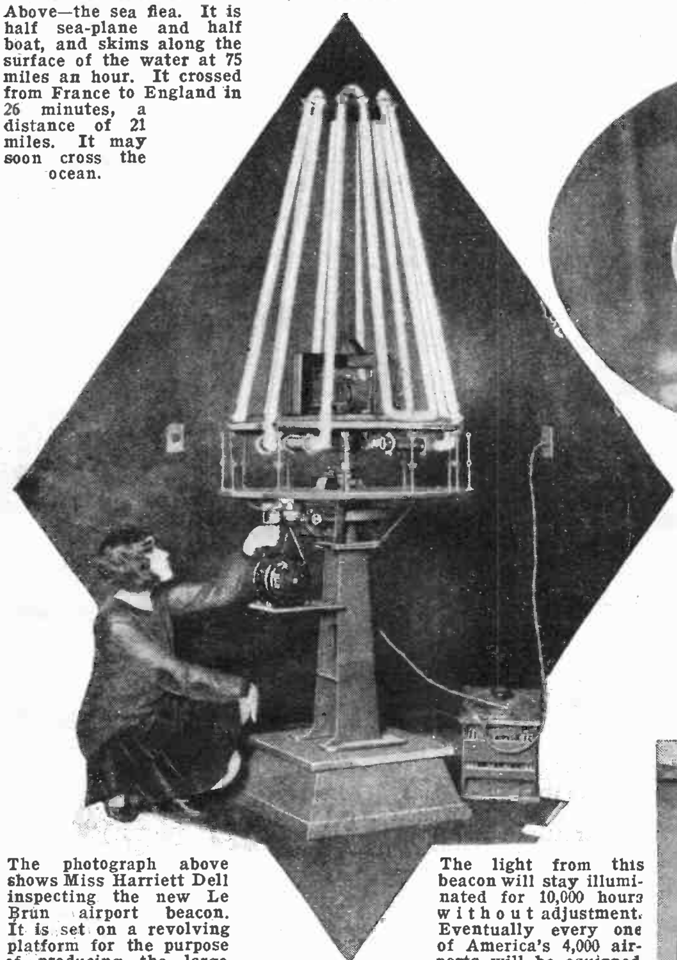


Above—the sea flea. It is half sea-plane and half boat, and skims along the surface of the water at 75 miles an hour. It crossed from France to England in 26 minutes, a distance of 21 miles. It may soon cross the ocean.



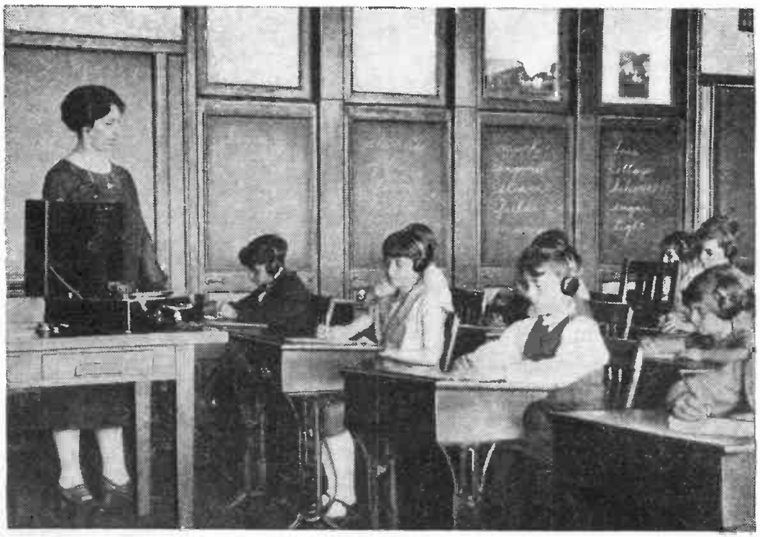
Above we find a shoemaker's lamp at least a hundred years old. It was located in Paris by Dr. Finley. It consists of four crystal globes filled with water, which serve as lenses, focusing the light of a candle in four bright spots. By the same light, four jewelers or shoemakers were able to work.

At the left, on the other hand, we find one of the new beacon lights which penetrates fog. This light supplies a beam of more than 1,300,000 candlepower. It can be seen for a distance of a hundred to one hundred and twenty miles, and it is claimed that it will penetrate any fog and still shine for that distance. The light is of red color.

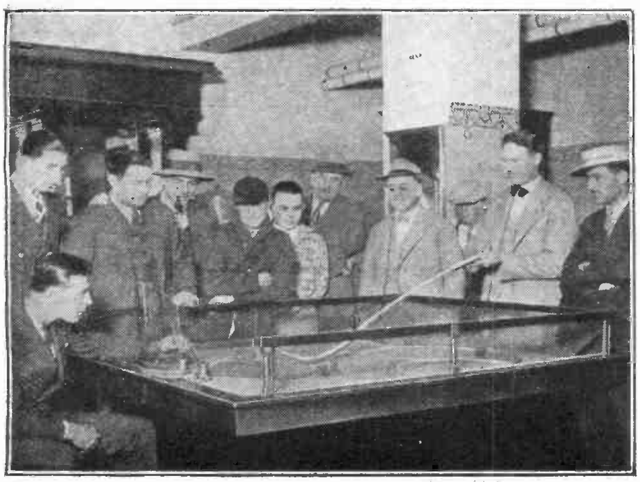


The photograph above shows Miss Harriett Dell inspecting the new Le Brun airport beacon. It is set on a revolving platform for the purpose of producing the large cone shape beam.

The light from this beacon will stay illuminated for 10,000 hours without adjustment. Eventually every one of America's 4,000 airports will be equipped with them.



The above photograph shows a new hearing device to test the normality of the hearing of school children, as it is installed in a Chelsea, Mass., school. There is an instrument resembling a phonograph with an electrical pick-up. This connects to 40 headphones. A record is placed on the machine and the children are asked to copy down the numbers which the record calls off. The energy is gradually diminished so that the teacher can instantly tell at what point the pupils failed to hear. The phone is then switched to the other ear.

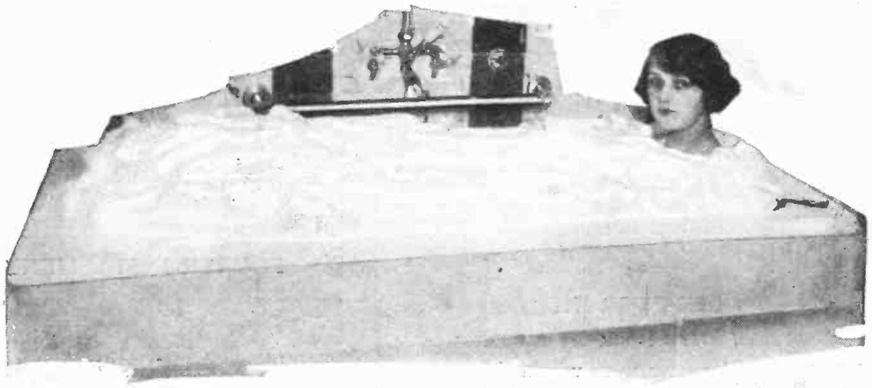


At the left we have a miniature baseball game, which is rapidly growing popular. The photograph shows Elliot playing against Lefty O'Dowell, outfielder. If Elliot can slide the little ball down the groove, and make it hit the back stop, he scores a strike. If O'Dowell hits it with the little swiveled bat, he gets an out, hit, or run, depending on where the ball lands.

# Many Fields

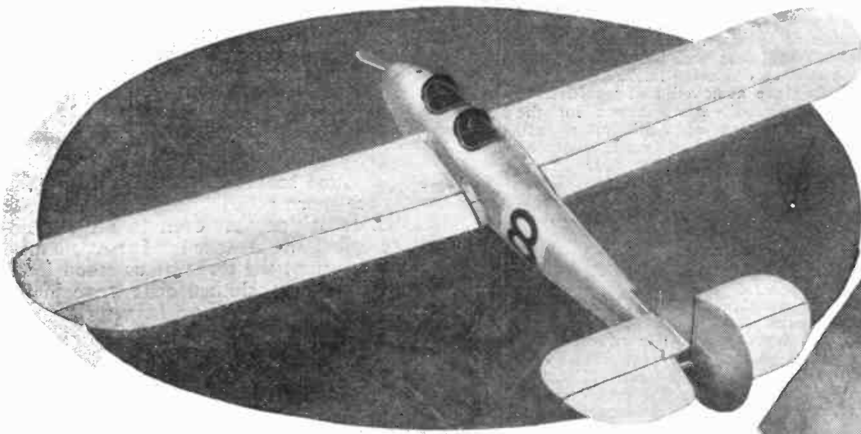
## AS SNAPPED BY THE CAMERAMAN

upon what ancient classical life must have been. Then refer to the page in this magazine showing the searchlight for projecting pictures on the clouds and let your imagination wander to what the future may bring. Perhaps one of your imaginative ideas will also find its way to a page of this nature. It may be one of the advances of modern times. There is a Chinese proverb that a picture is worth ten thousand words. Undoubtedly you could write more about advances in any of the fields here illustrated.

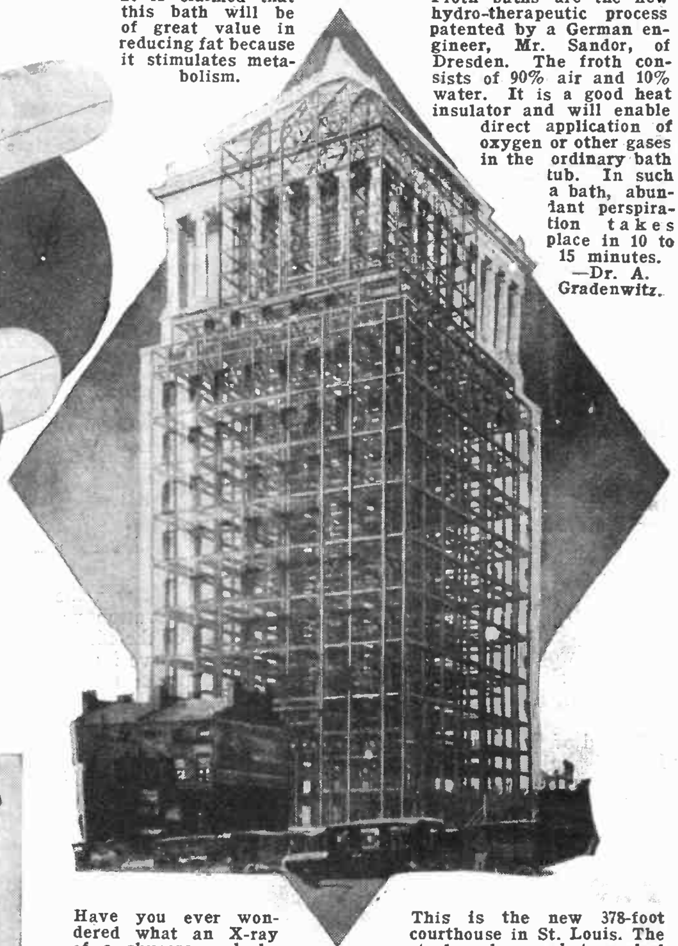


It is claimed that this bath will be of great value in reducing fat because it stimulates metabolism.

Froth baths are the new hydro-therapeutic process patented by a German engineer, Mr. Sandor, of Dresden. The froth consists of 90% air and 10% water. It is a good heat insulator and will enable direct application of oxygen or other gases in the ordinary bath tub. In such a bath, abundant perspiration takes place in 10 to 15 minutes. —Dr. A. Gradenwitz.

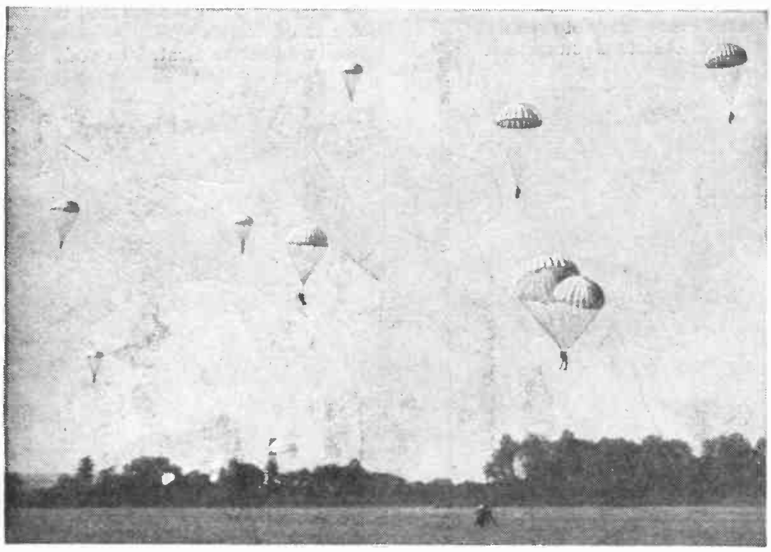


Here we find a new model of an English plane which can be described as being a two-seater chummy aerial roadster. Although originally built two years ago, it is just becoming popular now. With the exception of wing spars and covering, it is constructed of metal and fitted with a 32 horsepower engine. The plane has a top speed of 70 miles an hour, with a landing speed of 40 miles an hour, and it can climb at the rate of 250 feet a minute. This plane, because of its well balanced design, is considered to be very safe. One sees, therefore, that it is not America alone which is opening her eyes to the possibility of aviation. A plane in every family will soon be the rule rather than the exception.

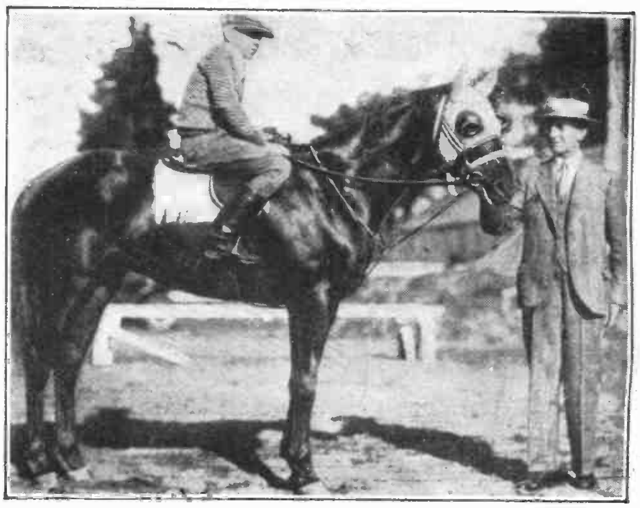


Have you ever wondered what an X-ray of a skyscraper looks like? Well, here is one.

This is the new 378-foot courthouse in St. Louis. The steel work was photographed and then printed through a photograph of a 4-foot plaster model.



The above photograph shows nine parachute jumpers in the air at one and the same time. This is the result of a demonstration indicating the ease at which a passenger could leap from a passenger plane, in event of an emergency. The nine navy and marine corps men jumped into space one after the other in the elapsed time of 18 seconds. But perhaps as the airplane is developed, emergencies in the air will not arise and it will no more be necessary to leap from a plane than it is necessary to leap out of a moving automobile.



At the right we have a photograph of a horse with eye-glasses. It has been found that some horses, particularly as they get older, are not able to see the ground as well and consequently, they do not make as good time on the race tracks. By fitting them with glasses, as this photograph indicates, the horse was able to better his time in a race by several seconds.

# The Metal Emperor

by A. Merritt
Author of "THE MOON POOL", "THE FACE IN THE ABYSS" etc.

FOURTH INSTALMENT

## CHAPTER XII

"WITCH! GIVE BACK MY SISTER!"

HOW long we were within that glare I do not know; it seemed unending hours. It was, of course, only minutes—seconds, perhaps. I became aware of a permeating shadow, a darkness gentle and healing.

I raised my head. We were moving tranquilly, slowly—with a curious suggestion of homing leisureliness, through a soft, blue, shimmering darkness. There seemed to be a film over my sight, dazzlement from the unearthly blaze, I thought, shaking my head impatiently. My eyes focussed upon an object a little more than a foot away, and my neck grew rigid, my scalp prickled, while I stared, unbelieving.

That at which I stared was—a skeleton hand. Every bone grayish black, sharply silhouetted, clean as some master surgeon's specimen, it was extended as though clutching at—clutching at—what was that toward which it was reaching?

Again the prickling over scalp and skin—for its talons stretched out to grasp a steed that Death himself might have ridden, a rack whose bare skull hung drooping over bent vertebrae. I raised my hands to my eyes to shut out the ghastly sight. And swiftly the bony hand moved toward me, was before my eyes, touched me.

The involuntary cry wrested from me was strangled by swift realization.

The skeleton hand was my own. The mournful, ghastly mount of death was—our pony. And when I looked again I knew what I would see—and see them I did—two tall skeletons, skulls resting on their bony arms, leaning against the frame of the beast.

Ahead of us, floating poised upon the surface of a glistening cube, were two women skeletons—Ruth and Norhala.

### Synopsis

Dr. Louis Thornton is traveling through Tibet with his Chinese servant-cook, Chiu Ming and two ponies that carried the impedimenta. They came upon a white man who introduces himself as Richard Keene Drake. Drake's father had been very friendly with Thornton. The three decide to carry on and come upon Martin Ventnor, a geologist, and Ruth, his daughter. The latter are guarding themselves against hundreds of soldiers who belong to an age at least twenty centuries back. While escaping they are attacked and would have been exterminated, were it not for the timely intervention of Norhala, a tall, beautiful, metallic-haired woman, whose control over lightning and over heavy metallic blocks was phenomenal. These blocks, at her command, would make a bridge for her to walk on or form themselves into battling monsters to protect her or obey her every whim. Chiu-Ming is killed in the battle, the survivors leaving with Norhala. Ruth and Norhala get on one of the blocks. The others stand upon a second composed of four smaller ones joined together by their own peculiar super-normal power. The platforms speed through space at a terrific rate. Not entirely without adventure, the group finally arrive at a region of intolerable life, Ruth still with Norhala—but not the same Ruth.

It was the light about us that did it. A vibration within the partly explored region of the ultra-violet and the unexplored region above it; the home of the Roentgen ray and those other radiant phenomena akin to it. Yet there were differences, for there was none of the misty halo around the bones seen always with the X-rays, reminders of the flesh which even they cannot render wholly invisible. The skeletons stood out clean-cut, with no trace of fleshly vestments.

I crept over.

"Don't look up yet," I said. "Don't open your eyes. We're going through a queer light. It has an X-ray quality. You're going to see me as a skeleton—"

"What?" shouted Drake. Disobeying my warning, he straightened, glared at me. And disquieting as the spectacle had been before, fully understanding it as I did, I could not restrain the shudder that went through me at the strangeness of that skull which was his head thrusting itself toward me.

The skeleton that was Ventnor turned to me and was arrested by the sight of the flitting pair ahead. I saw the fleshless jaws clamp. They opened to speak.

Abruptly upon the skeletons in front of us the flesh came back. Girl and woman stood there once more robed in beauty. So swift was the transition that even to my matter-of-fact mind it smacked of necromancy. The next instant the three of us stood looking at each other, clothed once more in the flesh, and the pony was no longer the steed of death, but our shaggy-haired, patient little companion.

The light changed. The high violet had gone from it. It was shot with yellow gleamings like fugitive sunbeams. We were passing through a wide corridor that seemed to stretch unendingly. The yellow light grew stronger.

The corridor opened into a place for whose immensity I have no images.

Temple it was in solemn vastness, but unlike any temple ever raised by human toil. Within its silence brooded a spirit, unearthly and gigantic. In no ruin of earth youth had I ever sensed a shadow of the strangeness with which this was instinct. No—nor in the shattered fanes that once had held the gods of old Egypt, nor in the pillared shrines of Greece, nor of Rome.

All these had been dedicated to gods that,

whether created by humanity, as science believes, or creators of humanity, as their worshipers believed, still held in them that essence we term human. The spirit, the force, that filled this place had in it nothing of the human.

No place? Yes, there was one—Stonehenge. Within that mystic monolithic circle I had felt a something akin to this; an inhuman, a brooding spirit, stony, stark, unyielding—as though not men but a people of stone had raised the great Menhirs.

This was a temple built by a people of metal.

It was filled with a soft glow, like pale sunshine. Up from its floor arose hundreds of tremendous, square pillars, down whose polished sides the crocus light seemed to flow. So wide was the space between them that Notre Dame itself might have been placed within it—nor would its highest towers have reached their tops.

Far, far as the gaze could reach, the columns marched, oppressively ordered, oppressively mathematical. And from this massiveness distilled an aura mysterious, mechanical, yet living; something priestly, hierophantic—as though they were guardians of a shrine.

High up among the pillars floated scores of orbs, pale-gilt frozen suns. Great and small, through all the upper levels these strange luminaries gleamed, fixed and motionless, hanging unsupported in space. Out from their shining spherical surfaces darted rays of the same pale gold, rigid, unshifting, with that same suggestion of frozen stillness.

**". . . The floating figures of Norhala and Ruth had drawn close to the disc . . . Ventnor broke into a run, holding his rifle at the alert . . . For Norhala had soared up toward the flaming rose of the disc . . . and past her floated Ruth . . ."**

Slowly, now, we were gliding through the forest of pillars. So effortless, so smooth our flight that we seemed to be standing still, the tremendous columns flitting past us, turning and wheeling around us, dizzyingly. My head swam with the mirage motion, I closed my eyes.

"Look!" Drake was shaking me. "Look!"

Half a mile ahead the pillars stopped at the edge of a quivering curtain of green luminescence. High up past the pale gilt suns its smooth folds ran, into the golden amber mist that canopied the columns. In its sparkling was more than hint of the dancing corpuscles of the aurora. And all about it played shifting, tremulous shadows formed by the merging of the aureate light with the curtain's emerald gleaming.

Up to its base swept the cube that bore Ruth and Norhala and stopped. From it leaped the woman, drew Ruth down beside her, and turned and gestured toward us. That upon which we rode drew close. I felt it shudder beneath me, felt, on the instant, the magnetic grip drop from me, angle downward and leave me free. Shakily, I arose from aching knees. Ventnor flashed down and ran, rifle in hand, to his sister.

Drake stooped for his fallen gun. I moved unsteadily toward the side of the clustered cubes. There came a curious, pushing motion, driving me to the edge. Sliding over upon me came Drake and the pony. The cube tilted, gently, playfully—and with the slightest of jars, the three of us stood beside it on the floor, the little beast stretching its legs, lifting its feet and whinnying.

The four blocks that had been our steed broke from each other. That which had been the women's glided to them. The four clicked into place behind it and darted from sight.

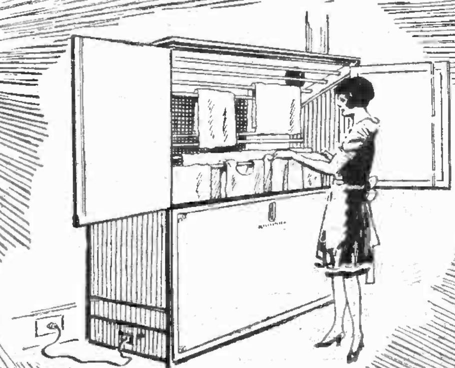
"Ruth!" Ventnor's voice was vibrant with his fear. "Ruth! What has she done to you?"

We ran to his side. He stood clutching her hands, searching her wide, unseeing, dream-filled eyes. Upon her face had deepened the calm and stillness that were mirrored reflections of Norhala's unearthly tranquility.

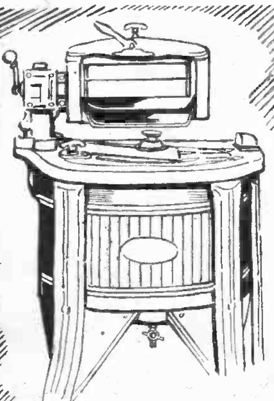
(*Continued on page 840*)

# ELECTRICAL SHOW

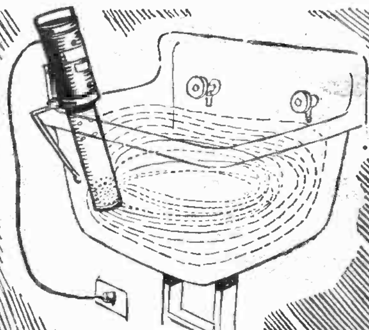
The above shows how the new electrical saw is used. With its aid one man can accomplish the work of five.



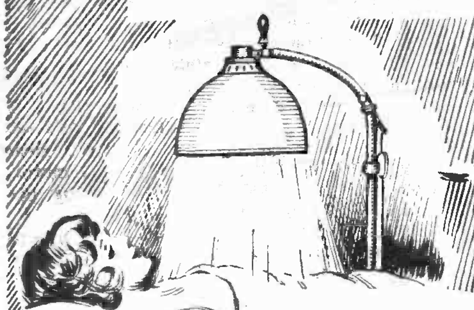
No more need the modern housewife hang her clothes on the line and wait for the sun to shine and the wind to blow. Here is an electrically-heated clothes-drier.



Here is a very reasonably priced combination washer and wringer. Either can be worked independently of the other, if desired.

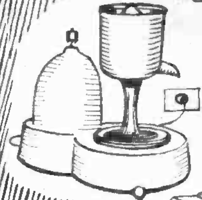


One of the lightest washing machines is indicated above. This fits into any tub and will handle three sheets or the equivalent.

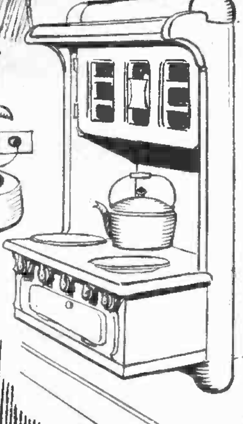


Infra-red rays produce a penetrating heat which will not burn the tissues. This is for medical treatments.

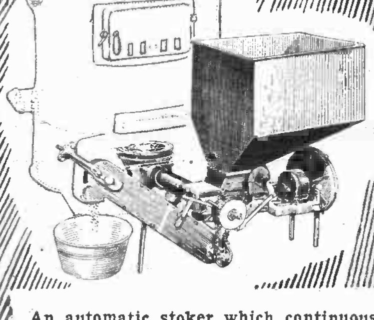
The motor shown above will do everything from slicing potatoes to kneading dough for bread. An attachment will even clean your silverware.



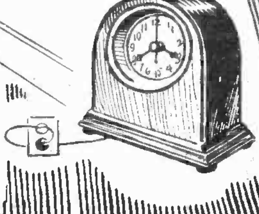
Above we have a juice extractor which will take care of citrous fruits. It is electrically operated.



For the modern apartments, we find the new styles of electrical stoves exhibited at the Electrical Show which set into the wall.



An automatic stoker which continuously feeds the fire and removes the ashes. It can be thermostatically controlled.



An electric clock for alternating current circuits is indicated at the left. This, when once set, remains accurate to the second.

# IN NEW YORK—

The newest types of lamp shades are made of celluloid, artistically decorated and opalescent in their texture.

This motor-driven washer washes clothes in your tub by the vacuum cup principle. It can also be used with various attachments for sharpening knives, operating cream whippers, etc.

A floor polisher, waxer or scrubber, motor-driven, is indicated here. When in operation, it can be guided with one finger.

Here is an automatic percolator with a thermostatic arrangement in the base, making overheating impossible. A button re-sets the thermostat.

The sun ray treatment is not left for hospitals alone. Here is an ultra-violet lamp for home use.

A Christmas tree holder with lights at its base, outlets for tree lights, and a well for water is shown above.

Here is a washing machine with a whirling drier, all portions of which are heavily coated with enamel. The drier has no holes.

ONE can always expect to find something new and novel in the electrical field at the yearly Electrical Show held in Grand Central Palace, New York, and on these pages we show only a few of the high-lights of the countless numbers of electrical articles which impressed thousands of visitors who daily surged through this monster exhibition palace.

Unfortunately, in this small space we can say but a few words concerning each of the various items.

For instance, there is a handy electric saw which can be used in many different ways. The saw is of the rotary type, driven by an electric motor. It can be used for breaking up wooden concrete forms, making shelving, sawing out boards, notching rafters, mitering, cutting out pockets and many other purposes. It is attachable to the ordinary socket and can be used wherever wood is to be cut, whether at plants, factories, hotels, machine shops or lumber camps. The physical exertion is entirely absent with an article of this nature, and one man can do the work of five men ordinarily. Well balanced and guarded, with an adjustable cut, the tool presents a very satisfactory product.

A little further on in the exhibition palace we come upon a new washing machine, very reasonable in price. This machine has a corrugated disk in the top, made of aluminum, which forces hot suds through the clothes 120 times every minute. The tub is made of copper, nickel lined, and so is easy to keep clean. The wringer connected with the motor can be operated independently of the washing machine, or both may be operated together. The outstanding feature of this article is its simplicity and its moderate cost.

We have but to turn around and we find another exhibit in the form of a lamp producing an intense penetrative heat. This lamp produces an abundance of infra-red rays and is employed medically in the treatment of pains resulting from inflammations or bacterial invasion. While producing intense heat, there is little danger of a burn. It is claimed that the lamp gives excellent results in the treatment of rheumatism, congestions, colds, and wherever heat is desired.

Many of us have coal furnaces and would like to convert these furnaces into automatic systems. The present age seems to be gradually turning to the employment of things entirely automatic in their action. For those who prefer to keep their coal-fired furnaces, there is an automatic stoker which can be attached to any furnace or boiler, and it will feed buckwheat or rice coal to the fire-pit and insure its proper combustion. This stoker is fitted with a blower, which supplies the air for the proper combustion of the coal, and also has a continuous worm feed for the coal, coupled to a thermostat. The coal placed in the hopper is gradually fed into the furnace at a rate depending upon the desired temperature. As it burns and turns to ash, another continuous worm conveys the ashes out from the fire-pot to the receiving hopper. The only attention which a furnace of this nature requires is the filling of the hopper with coal and the removal of an ash-can occasionally.

Turning our attention for a moment to articles for kitchen use, we find a new style of electric stove which should be ideal for modern small apartments. This is a three-burner type electric range, which fits right into the wall, thus saving space. Each stove is properly ventilated so as to carry off cooking odors and inasmuch as there are no legs, there is no difficulty in sweeping or mopping under it.

For the same kitchen there is an interesting electric range and lemon juice extractor with a whirling spinner run much the same as those used at large soda fountains. The article is easily cleanable.

The housewife who finds that she must prepare meals for a rather large family can see the advantages in a food mixer, meat chopper and general all-around utility motor, which will do everything from peeling potatoes to mixing dough.

Then there is an electric clock which keeps absolutely accurate time. It is connected directly to the 110-volt source of supply and consumes but two watts of energy. Nevertheless, in most cities (depending of course on the source of current supply), this clock continues to accurately check off the hours, correct to the second.

For the home laundry, a clothes drier that will dry the clothes electrically in less than an hour, will be found on exhibition. By its aid, it does not make any difference whether the wind is blowing or whether it is raining, the clothes dry just the same and dustlessly, without the possibility of tearing. This consists of an electrical heating coil in the bottom of a large cabinet, arranged for the free circulation of air with suitable racks upon which the clothes are suspended.

There are, of course, many washing machines of different types. Each individual owner likes his own kind of a machine, but one of the midgets in size that does remarkable work is a motor-driven turbine wheel set right into any wash tub. This sucks in the water through a large number of holes and then ejects it forcibly, causing the water to circulate in and about the clothes and agitating the clothes quite vio-

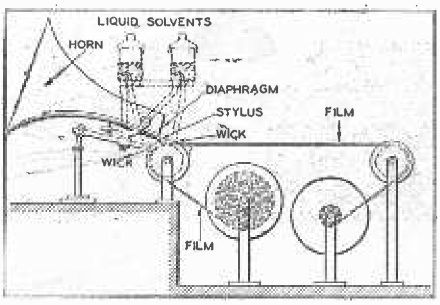
(Continued on page 869)

# Old Film Used to Record Voice

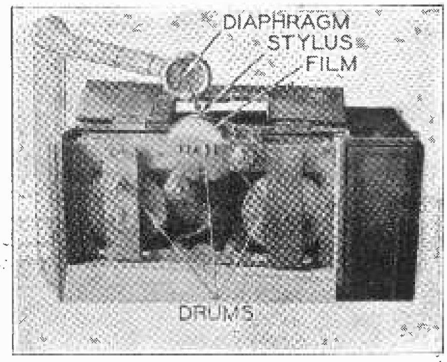
**By LUCIEN FOURNIER**

The above photograph shows Francis M. Johnson with his new machine which records sounds on old or new movie film.

THE Phonetic Institute of Sorbonne College has recently made public the discovery of two inventors, Francis Morton Johnson and his wife. This startling new invention makes it possible to record sounds on old moving picture films, which can then be reproduced similar to the records used in the present day phonograph. Up to the present time many attempts have been made to register sound upon moving picture film, but all have been futile because the point of the stylus tore the film as it was pressed upon it. Under the best conditions rough impressions were obtained which could not reproduce accurately the original sound. Although the surface of the film was softened by a solvent, before passing the point over it, accurate reproduction was never obtained. These troubles, however, have been avoided by the successful inventors who have discovered dissolving liquids with which they coat the film before and after the passage of the needle. Besides this, the needle is heated so as to penetrate better into the surface, which is thus slightly softened; in order to make impressions devoid of all roughness. This softening process is entirely local and affects only a very small portion of the film, just enough to let the needle form its groove. Behind the needle the apparatus deposits a liquid which cleans out the groove which has been traced by the needle. This gives a perfectly clear reproduction of the sound.

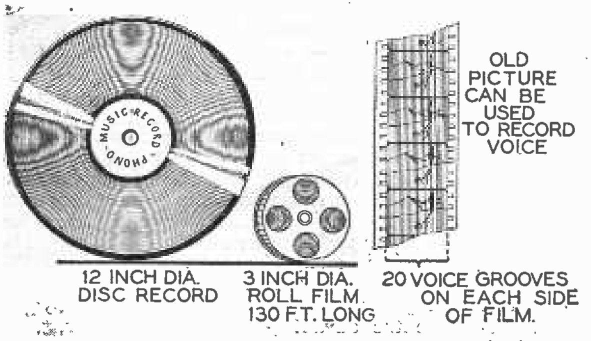



The method used in recording speech on the old films is made clear in the above illustration.



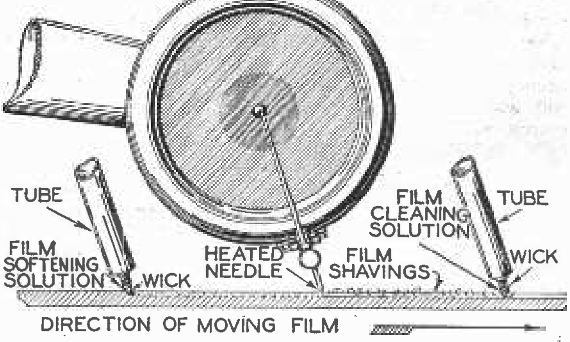

Above we have a photo which shows a side view of the machine. The three revolving drums upon which the film is wound may be seen.

The solvents are very active and evaporate almost immediately after they have performed their functions. Thus, the film can be rolled almost immediately and used for the repetition of the recorded sounds. The photographs and diagrams shown here will clearly explain the action of the apparatus. As the registering of the words is done upon the film nothing is easier than to carry it out in perfect synchronism with a visual scene. It should not be difficult to add this system to the small moving picture cameras used by amateurs.



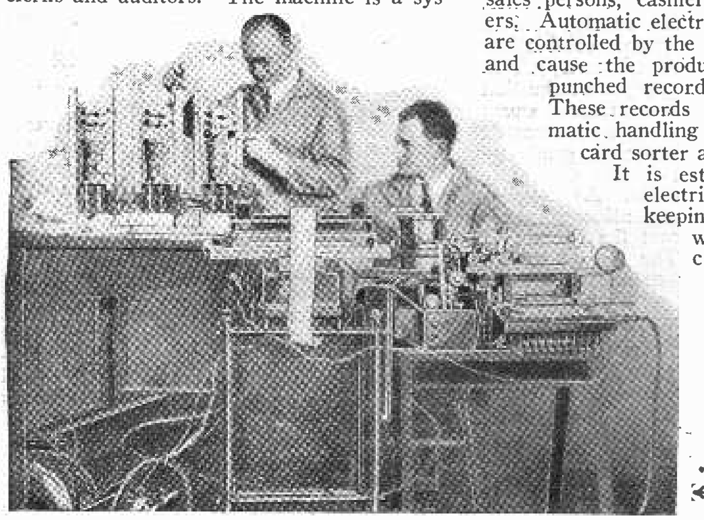

At the right is a drawing showing how the film softening and cleaning solutions are applied through small tubes. The softening is entirely local and affects only a very small area of the film.

At the left we see the advantage of this new method of voice recording. Twenty voice grooves may be made on each side of the film and a film 130 feet long makes a small roll only 3 inches in diameter.

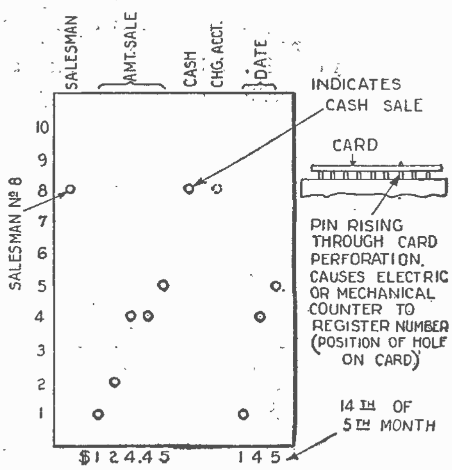



# Automatic "Clerk" Aids Business

A NEW device has recently been invented by L. F. Woodruff and Edward Rogal which does the work of countless clerks and auditors. The machine is a system for automatic sales audit and inventory record control in large stores and factories. Small punched tags indentify the goods, sales persons, cashiers and charge customers. Automatic electric transmitting devices are controlled by the insertion of these tags and cause the production of printed and punched records in a central office. These records are suitable for automatic handling by standard punched card sorter and tabulator machines. It is estimated that this new electrically controlled bookkeeping machine will do the work of 60% of the clerks, auditors and messengers now employed in large department stores and factories.



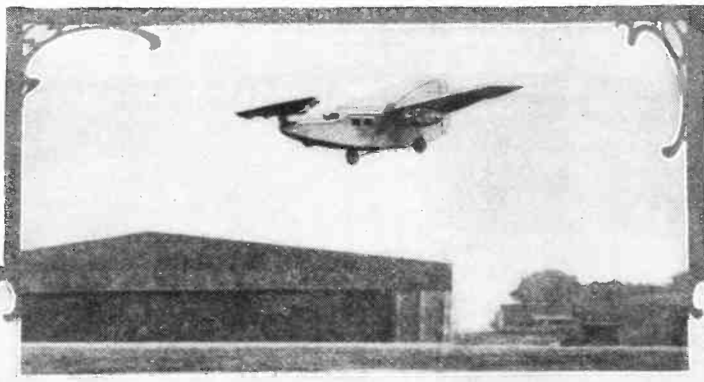
The photo at the left shows L. F. Woodruff and Edward Rogal making the final tests on their new electrical bookkeeping machine. This machine will do the work of 60% of the clerks and auditors now employed in department stores and factories.

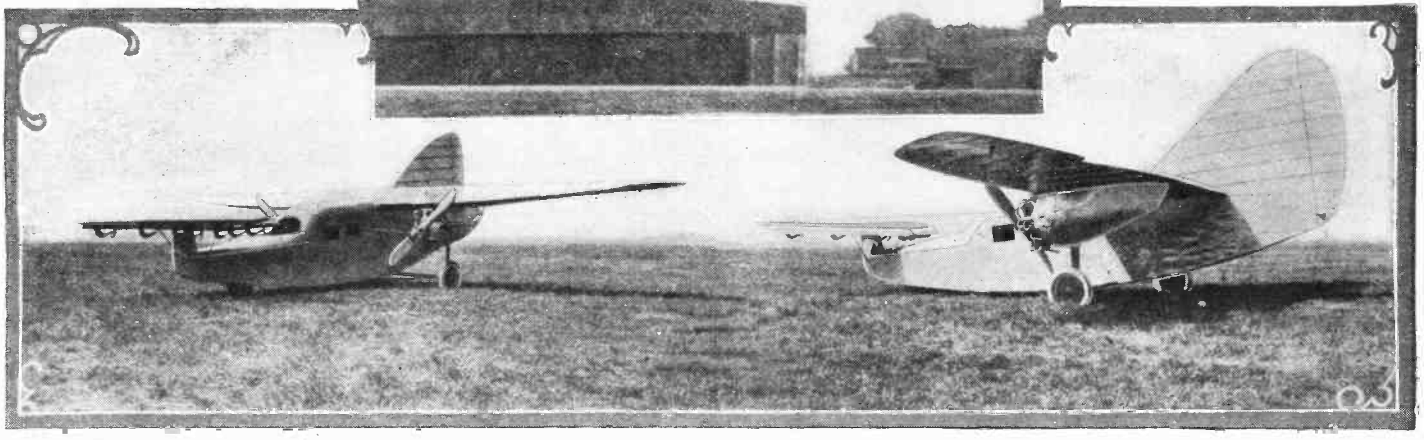



The sales record card is shown above.

# DOES THIS PLANE FLY BACKWARD?

A new type of airplane has recently been built in Germany by the Focke-Wulf Air Co. The design is a radical departure from all previous ones. The tail planes and rudder are in the front and main wings and motor are in the rear. Great reliability and safety are some of the characteristics of this new arrangement. Even with imperfect flying, the plane will not overturn in the air when taking off or upon landing. The success of the trial flight has caused much comment.

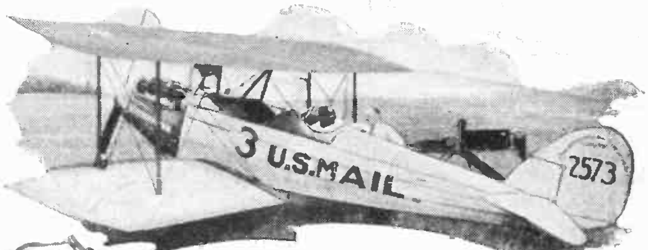




Three views of the new airplane are shown here. Notice that the motor is in the back with the propellers facing in the opposite direction to those on other planes. The new plane which is called the "Duck" has made several successful flights and is considered to presage a new era in airplane building. The upper photo shows a view of the new plane during its test flight. The two photos below show a view of the plane from the front and from the rear.

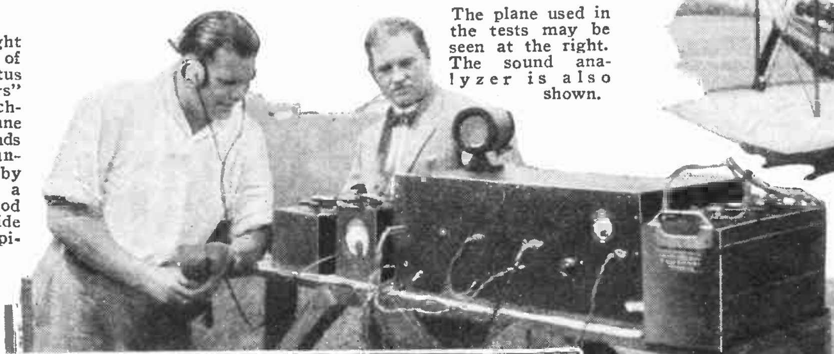
# SOUND OF PLANE TURNS ON GROUND LIGHTS

THE successful automatic lighting of an airport was recently demonstrated at Bettis field, McKeesport, Pa., when the hum of the motor of an air mail plane 1,500 feet above the field switched on a bank of flood lights. The sound sensitive agency automatically closing the light circuit was developed by Mr. T. Spooner, research engineer of the Westinghouse Elec. & Mfg. Co. Roughly, the device consists of a microphone, tuning and amplifying circuits and a time element relay. The hum of the motor is picked up by the microphone and the currents thus induced in the microphone circuit are transmitted to a resonant circuit, tuned to the frequency of the hum of the motor, which not only amplifies it but eliminates all currents which might be induced by other sounds. The time element relay is so adjusted as to function only after the sound has persisted for an unbroken period of ten seconds. This prevents the action of the apparatus through the short reception of sounds, which may have the same frequency as the tuned circuit. The energy received by the microphone is relatively weak, but after it passes through a bank of amplifiers it is capable of closing a good sized lighting switch. This switch locks automatically and the lights remain on until turned off by the field attendant. The lights which were used came from a new type of airport projector developed by the Westinghouse Co. This new unit is designed to furnish sufficient illumination over an uneven field, at the same time keeping the source of light low, and eliminating objectionable glare affecting the eyes of the aviator. A spread lens mounted in front of the light gives a horizontal diffraction of 45 degrees to the beam. This automatic ground light device will prove very useful when airplanes become more common than they are today.

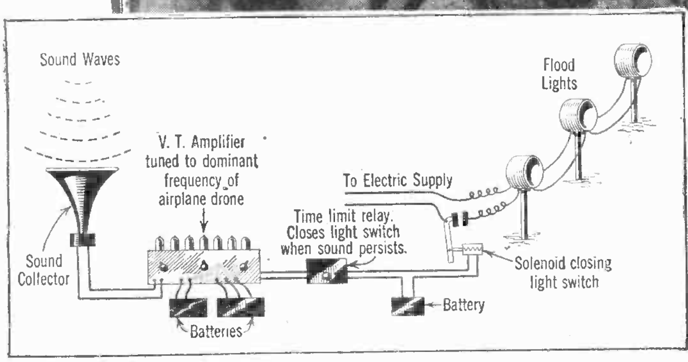




The plane used in the tests may be seen at the right. The sound analyzer is also shown.

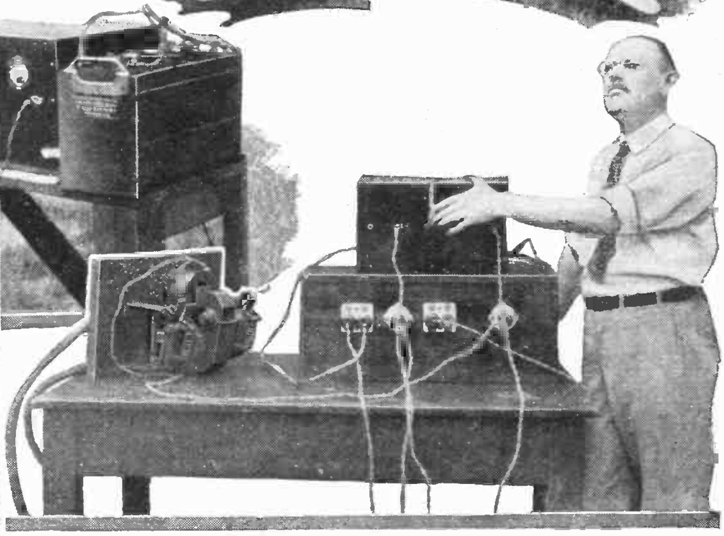


At the right is a view of the apparatus that "hears" the approaching airplane and responds to it instantaneously by turning on a bank of flood lights to guide the landing pilot.





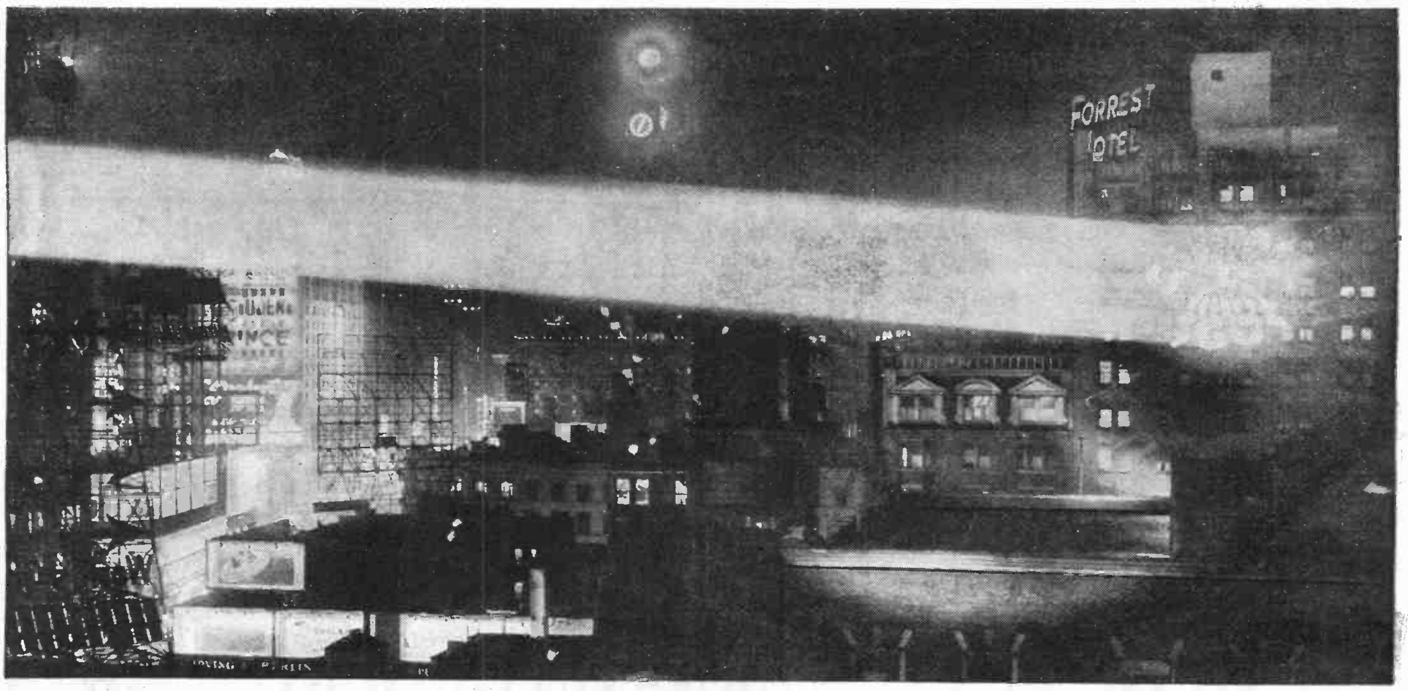
A diagram of the new automatic lighter is shown above.



Another view of the apparatus.
*Photos courtesy Westinghouse Elec. & Mfg. Co.*

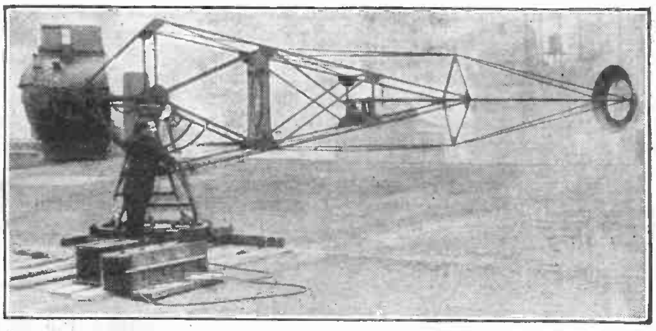
# Sky Signs for Advertising

## Four Million Candlepower Magic Lantern Projects Pictures on Clouds



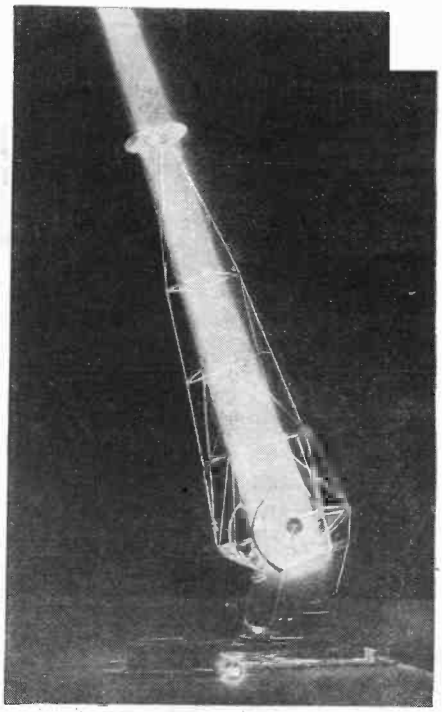

The above photograph shows an advertisement of the Capitol Theatre in New York being flashed on a building six blocks away. At this distance the sign is about 150 feet high and it can be read about two miles away. When skies are overcast, it is possible to project any advertisement in colors or black and white on the clouds so that thousands can read the sign. The lantern itself is different from the ordinary type, consisting of a four million candle-power searchlight and a large lens for focusing, as the photo below shows.

The photograph at the right is a daylight view of the huge lantern which can project pictures and advertisements on the clouds. As a matter of fact, the mechanism can be made for motion picture projection, inasmuch as here the film would travel through the lantern quickly enough to prevent it from burning. In stationary views, opaque metal slides are employed.



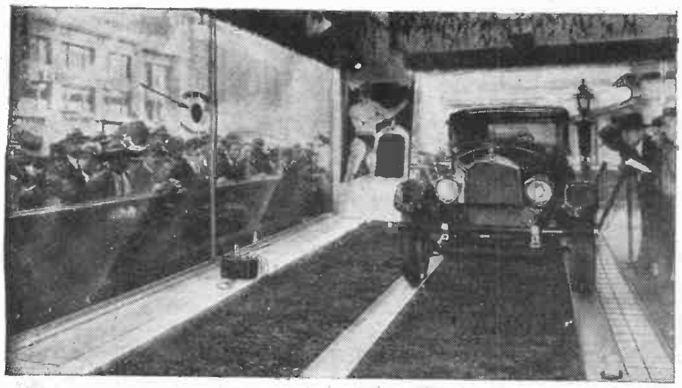
SUCH buildings as the Paramount Theatre Building, the Times Building, the Claridge Hotel and Loew's State Theatre Building, as well as many others in the vicinity of Times Square and Columbus Circle, are serving as colossal bill boards for the projection of advertisements from a four billion candle-power magic lantern on top of the Capitol Theatre at 51st Street and Broadway. The letters projected by this lantern are about 150 feet high when projected on nearby buildings. Of course, when they are flashed on the clouds, they become many miles in height.

Many buildings may form a portion of the same billboard for signs of this size. The lantern consists of a Sperry four billion candle-power searchlight, mounted on a pivot so that it can be swung with ease in any direction. One man can control it as easily as if it were a rifle, even though the apparatus itself is about 20 feet long. While it is not intended to use buildings as the screens, it is possible that airplanes flying across at right-angles to the beam will be able to drop a smoke screen or smoke curtain. This curtain can then be covered with any publicity desired. The lens on the end focuses the beam upon the smoke screen maintained by the plane flying back and forth.



This photograph shows the same searchlight lantern as it appears at night. Note the intensity of the light beam.

## WAVE OF HAND STARTS AUTO

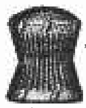


When a painted disk on a plate glass window is touched it will cause an automobile to start, reverse, and stop.

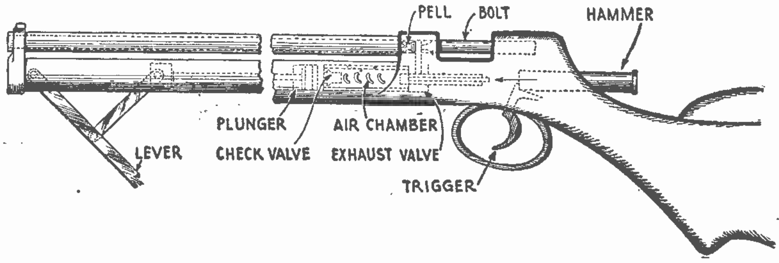
CROWDS were curiously contemplating the operation of an automobile when any pedestrian merely passed his hand over a hole in the center of a painted disk on a plate glass window. The automobile is operated by an electric motor which reverses when the automobile has run across the show window. The device which operates the car is the grid glow relay described in the July 1927 issue of this magazine.

# An Air Gun With Remarkable Power

The illustration on the left shows how a lever action is used to pump the air into the gun. This method makes the loading of it much easier than it would be if a straight plunger action was employed. The pell at left shows how the rifling marks it.



.22 Pell after firing




The action of the gun is shown here. Air is stored up in the chamber and is released when the hammer hits the exhaust valve.

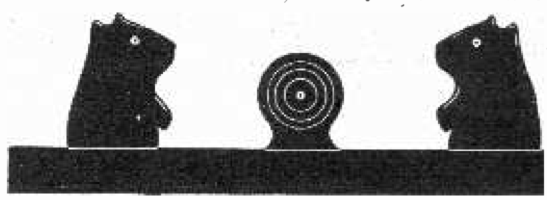
Showing quick and easy method of pumping. Four strokes are usually enough—more than six should never be used.

To load, hold gun as shown with hammer and bolt drawn back, and place pell nose foremost in chamber. Pressing bolt forward carries the pell into position and the gun is ready to fire.

A REMARKABLE air rifle which has pump action to build up the air pressure has recently been placed on the market. It is very pleasingly made, light, well balanced and closely resembles a carbine type of rifle. The pumping has been facilitated by using a lever principle. The valve action is arranged so that the compression may be built up as the lever is moved back and forth. Normally four strokes are sufficient, but this may be increased to six if more power is desired. Special lead slugs of .22 calibre are used in this rifle. These slugs are built apron fashion with a solid end in the front, and a hollow back to aid the power of the rifle. The gun is loaded by releasing the bolt and placing one of the lead "Pells," as they are called, nose foremost into the chamber. The bolt is then pressed forward and turned to lock it in position. The gun is then ready for firing. One advantage for target practice is that no cleaning is necessary, and since no powder is used, there is no danger of pitting in the barrel due to neglect. All that is necessary is to insert a small amount of medium motor oil into the plunger washer to keep it primed at rare intervals. The automatic target is made of ⅛-inch steel heavily enameled and weighs one and one-half pounds.

*Photos courtesy Crosman Arms Co., Inc.*

The complete rifle is shown in this illustration. The hammer and the loading lever can be seen above the trigger.

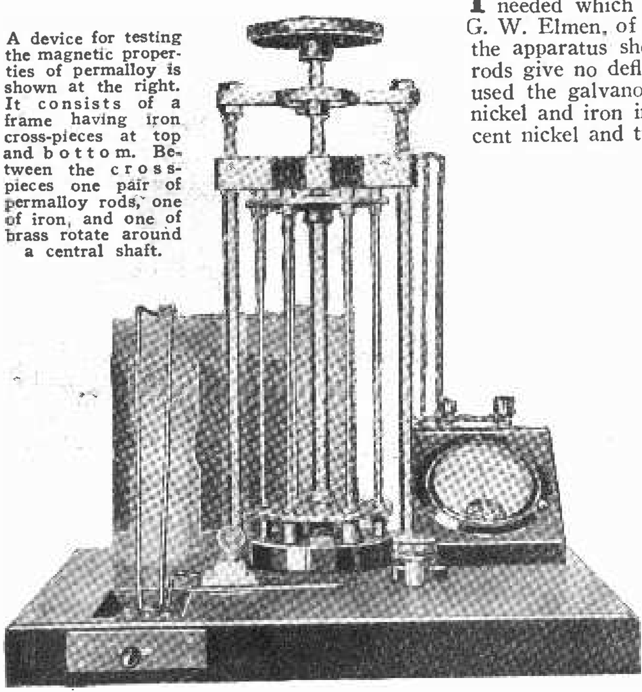


An interesting target, which is entirely automatic, is shown here. The two figures on the left and right are hinged and dropped down when hit. By hitting the bull's-eye in the center target, the two other figures are automatically raised again, and the target is ready for use.

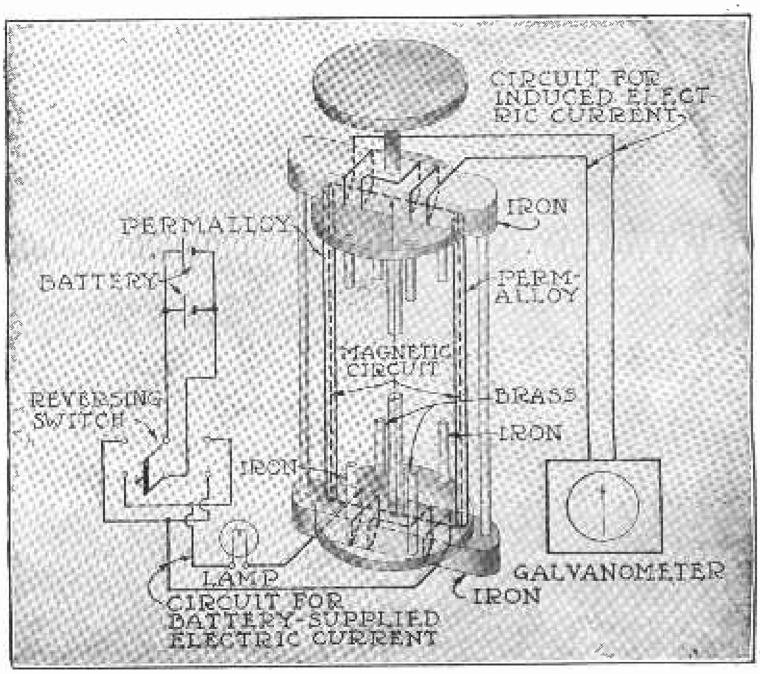
# Permalloy, A Remarkable Magnetic Substance

IN telephone loading coils, relays and other electrical apparatus a magnetic substance is needed which will respond to weak electrical fields. A special alloy invented by Mr. G. W. Elmen, of the Bell Telephone Laboratories, has proved far superior to iron. When the apparatus shown is used to compare magnetic properties of various substances, brass rods give no deflection; with iron rods a small deflection is visible, and when permalloy is used the galvanometer needle is thrown violently across the scale. Permalloy consists of nickel and iron in different quantities. The best combination seems to be about eighty per cent nickel and twenty per cent iron.—C. D. HANSCOM.

A device for testing the magnetic properties of permalloy is shown at the right. It consists of a frame having iron cross-pieces at top and bottom. Between the cross-pieces one pair of permalloy rods, one of iron, and one of brass rotate around a central shaft.



Details of the device are shown here. By turning the insulating handle at the top, the various rods are connected into the circuit. Batteries are connected to the coil on the lower cross-piece, through a reversing switch. When the switch is thrown, current goes through the coil and generates a magnetic flux in the circuit of rods and cross-pieces. When the brass rod is in the circuit, no deflection on the galvanometer is noticed.

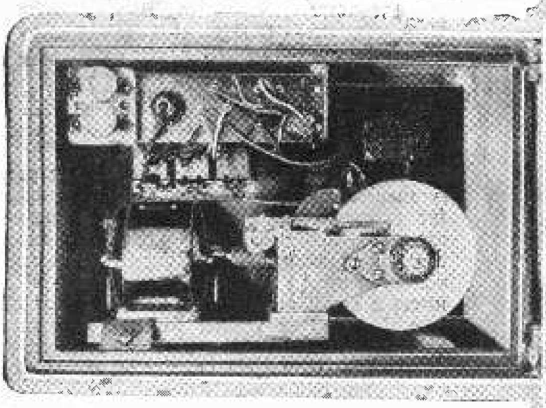


# Automatic "Policeman" Directs Traffic

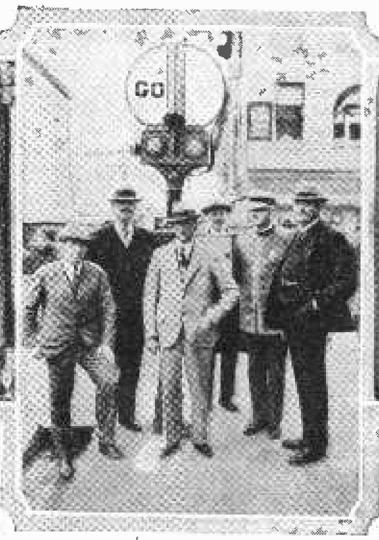
### By DOROTHY SHRENE

UPON the four corners of Pasadena's busiest streets, stand four semaphores of the usual height, but bearing instead of the plain flag arm used on all previous signals, a large, round, white disk, against which the words STOP words STOP and GO at mechanically regulated intervals.

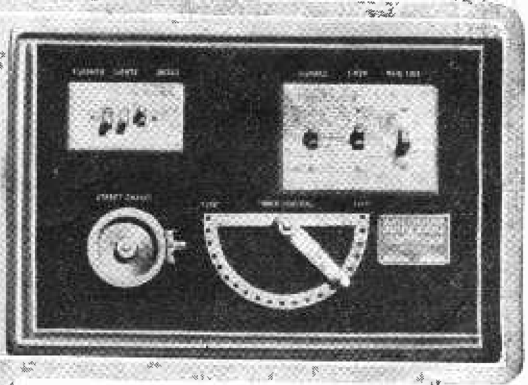
The white face of the disk is divided with a black iron border and intersection according to standard railroad practice. This out- mechanically from a central station. For example, the lever noted on the outside of the control box switchboard panel, marked STREET CHANGE, controls the round end of the arm seen just in front, and nearest to the center, of the revolving cam. This



A view of the control box is shown above. It contains a revolving cam which controls the head motor, lights and bell. This disk is operated by an electric motor.




One of the new traffic signals erected in Pasadena, California, appears above.



The control box switchboard panel is shown here. The street change and time control lever may be seen, also switches regulating the flasher, lights, bells and timer.

and GO in red and black respectively, leap out at you with startling vividness.

These are the Waterhouse traffic signals, invented and produced by a local business man, and adopted by Pasadena. They are being tried out by Portland, Oregon, and several other large cities.

Australia has sent her special representative, detailed for a years leave of absence to study traffic control all over the world, to investigate them. Mr. Lampero, who has seen many others in his trip of inquiry, compliments this signal as being one of the best he has yet encountered.

The Waterhouse traffic signal as it appears to the eye of the motorist or pedestrian, is a large, white, glassed disk, mounted upon an ornamental iron standard of the usual height, and possessing an arm lettered in red and black which rotates clockwise across the face of the disk to present the lines in bold relief the words upon the small flag arm.

The Waterhouse signal possesses the four essentials of all good traffic signals. It is easily seen, quickly understood, its installation and operation costs are low, and it never stops.

The simplicity of construction is readily seen when one examines the mechanism. A control box is mounted upon one of the four standards bearing the signals for each intersection. This box is constructed of cast aluminum, and contains a revolving disk, or bakelite cam, which, mounted upon the rotating signs, controls the head motor, lights, and bell. This cam is operated by a small electric motor, and is adjustable by means of a local control, or may be operated lever may be turned raising a small rubber disk, and allowing the cam to skid easily for the required suspended interval of action. Thus traffic may be held in check, or one street remain clear for a longer duration of time during an emergency, and may be so managed by the officer on duty in the street. The time control lever, noted with the extremes marked SLOW and FAST, rotates between these extremes in response to local management also, and controls the long, saw-like lever seen against the face of the white cam, and just above the rubber disk described.

By rotating the TIME CONTROL lever, the clearance period between change of traffic, or the interval of cycle of traffic may be changed to range from 30 to 90 seconds each, and may be set by the officer on the street, or the whole may be controlled by a central station.

*(Continued on page 857)*

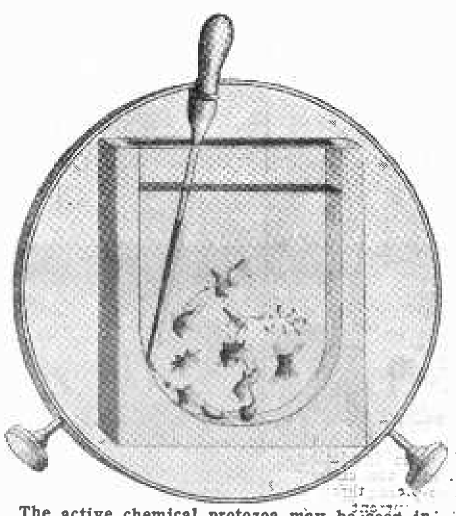
# Growing Living Chemicals

### By MAYNARD SHIPLEY

SUPPOSE that in a porcelain plate or dish, placed in a photographic developing pan, one dissolves 100 centimetres of pure gasoline with 50 centimetres of pure olive oil. Then in this solution, suppose one drops a mixture of 14 grams of caustic soda, 100 centimetres of warm water, and one gram of any coloring matter. What will happen?

Dr. Alfonso L. Herrera, director of the Biological Institute of Mexico City, who has conducted somewhat similar experiments for twenty-eight years, will tell you that the result will be the production of imperfect, artificial beings, which nevertheless display many of the characteristics of living protozoa.

When a few drops of the second solution are added to the first, the drops become covered with a thin soapy film, and an osmotic preparation is produced. The oil, rendered more fluid by the gasoline, rapidly penetrates these little sacs. Then the tiny artificial "creatures" can be seen to change form, to break up, to reform, to become filled with little vacuoles. By adding gum



The active chemical protozoa may be seen in the above photograph. This experiment can be easily duplicated with simple chemicals.

arabic, imitation beings are produced which are able to grow and to multiply by fission, sometimes dividing as many as five times in two hours. To these creatures Dr. Herrera has given the coined name of *colpoides*.

So much may be seen by the naked eye, and anyone who can obtain the simple chemicals needed can repeat the experiment. Under a microscope still greater marvels appear. The colpoïdes seem to fight and struggle together; they suck the juice from each other like tiny cannibals. Often indeed they eat each other up! As with living beings, the larger ones seize upon the smaller, and after a few minutes of strong suction, the smaller have disappeared!

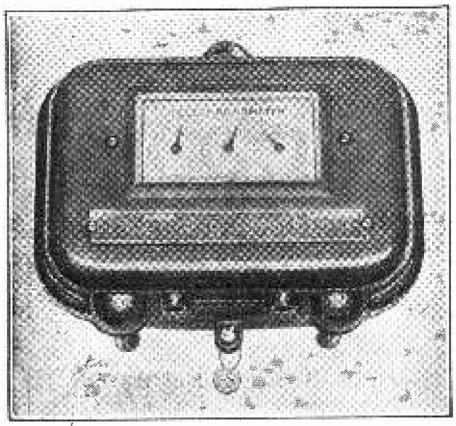
All this lasts for two or three hours. However, if one should focus the sunlight coming through a magnifying glass on the little creatures, they will become re-animated.

Add a bit more soda, colored differently for better observation, and the colpoïdes will send out processes to suck it in. It is only a physical effect, the equilibration of osmotic pressure but it is uncanny. Dr.

*(Continued on page 855)*

# Metered Telephone Conversation

By CHARLES F. A. MANN

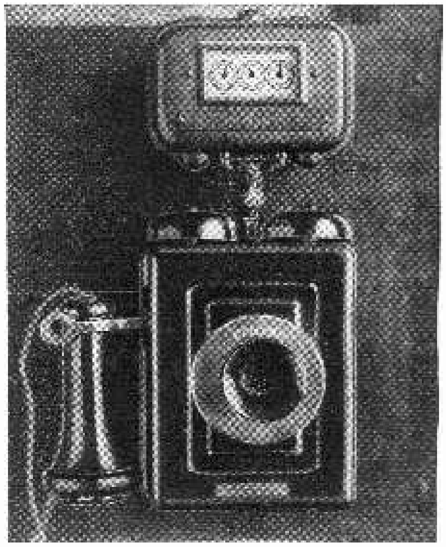


The new telephone meter or telechronometer, as it is called, is shown above. This device is fastened directly above the telephone.

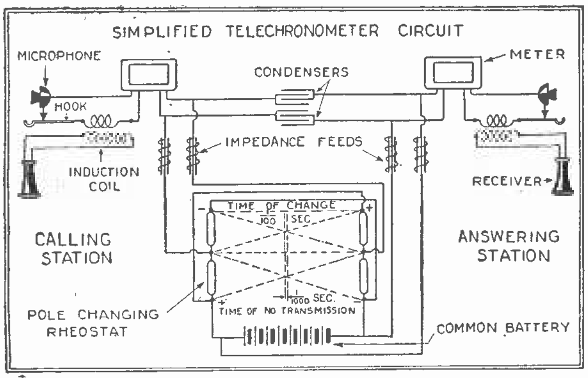
WITHIN a few years the American public may be using the pay-as-you-use-it plan in paying for their telephone service, instead of the flat monthly charge as now commonly used. In the Northwestern city of Everett, Washington, there is now in successful operation the first metered telephone service ever installed in any city in the world. It is based on the same principle as metering light, gas or water service and measures the service in its own peculiar unit, the unit of time. This unit of time has been termed by the inventors of the system the Telechrone, or the use of the line for one minute in conversation. A smaller unit for registering is termed the telo or the use of the line for fifteen seconds. The entire apparatus is installed in the exchange office and is silent in operation. The only change in the subscriber's telephone connections is that a small meter with four dials is installed directly above his telephone and is read by a meter reader once each month, just like gas or electric meters.

The device depends on the principle of changing the polarity of the line current from the central exchange through a Wheatstone bridge circuit, which is controlled by a set of compressed air operated solenoids working through carbon rheostats to eliminate all clicking noise on the line. This device is simple and compact and is known as the pole changer. This is controlled by a master clock which automatically changes the polarity of the line current once in fifteen seconds. When Mr. Subscriber takes down the receiver and the circuit is opened through his meter here is what happens: The minute the receiver is lifted the current begins to go through the phone and through the meter as connected in the circuit in his home, or office. Inside the meter is a polarized magnet which moves synchronously with the changing polarity of the line current caused by the pole changer in the exchange. Every fifteen seconds it moves once and by means of a ratchet wheel moves the meter ahead one notch and registers one Telo. Four of these Telos equals one telechrone, upon which the rate is based. The meter is so arranged that when the calling party hangs up it stops and does not register until the receiver is lifted again, incoming calls having no effect on the meter. Thus it is the one who calls that pays for the service. Between the hours of

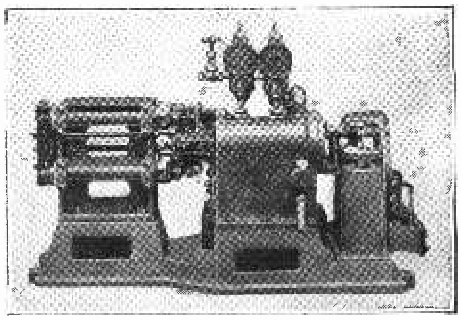
(*Continued on page* 858)



The complete installation is shown above with the meter fastened directly over the telephone box. This is the only change necessary to change from a flat rate to the new metered service. It has been estimated that this system will save a majority of people a considerable sum on their telephone bill.




The circuit of the new system is shown here. When the receiver is lifted from the hook, the current begins to go through the phone and through the meter connected to it, thus recording the time of conversation.



This shows the apparatus which is installed in the central office. It serves to change the polarity of the line current and is controlled by a set of compressed air operated solenoids.

# Science and Invention Fiction In Japan

The far-reaching effect of SCIENCE AND INVENTION Magazine is shown in this reproduction from a Japanese magazine of Ray Cummings' story "Into the Fourth Dimension." This story is being run in the Japanese magazine and is a direct copy of the story and illustrations published in SCIENCE AND INVENTION Magazine.

It would be rather difficult to read this story but fortunately you can read the complete story in back numbers of SCIENCE AND INVENTION.

電波科學小說

第四元の中へ

レ・カミング原作

田中掬翠譯

——人物——

人見良一（二十六歳）某商會紐育支店の通信員、筆者である。

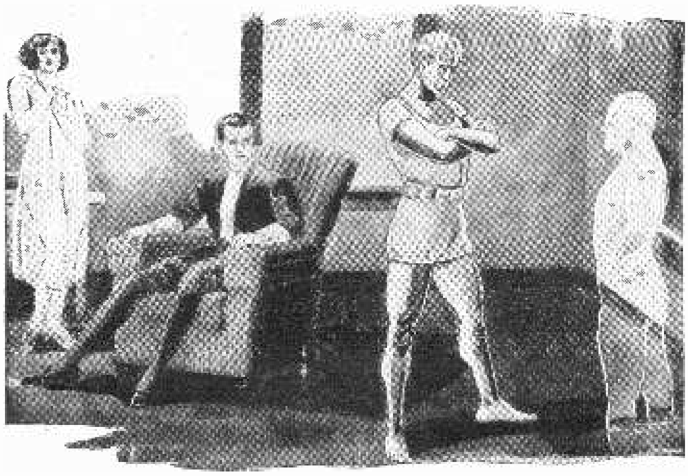
大山意一（四十歳位）紐育近郊に住む藥劑師。

妙子（二十四歳）大山意一の妹。

二

科學未到の國を尋ねて（續き）

見たところ、一方の肱に凭れて横臥してゐる人の姿の白光は絶えず振動してゐた。この幽靈の體軀は床面より少しく下にあつて、體の大部分は床の背後又は床の中にあつた。そして床の輪郭は幽靈の姿よりは明かに見えた。頭と肩とは我々の踵と同一の高さにあつた。人間であるか？ 余は到底然う呼ぶことは出來なかつた。しかも確かに人間の顔を持つてゐることは否定すべくもない。否それどころかその



# Can You Answer These Scientific Questions?

SCIENCE & INVENTION Magazine readers, especially our thousands of friends in schools and colleges everywhere, have frequently testified in their letters to the editors that they obtain invaluable help from the columns of this magazine, in clearing up technical questions which arise daily. It is a recognized fact that everyone today, including those of both sexes, are expected to have a fairly good general knowledge of the latest scientific developments and discoveries. It is quite impossible to obtain this knowledge of the latest conquests in science from text-books, as they are usually revised but once a year, and in many cases not as often as that. You will find the questions below a good challenge to your knowledge of modern science, and we advise you to form your own answer, before you turn to the page referred to in each case.

1. Explain briefly your idea of a ramp and how it is used. (See page 784.)
2. How can the toot of a whistle open and close your furnace draughts when you are not at home, and perform many other chores? (See page 786.)
3. What is your reason for birds migrating as the seasons change? Frame your reason before turning to page 787.
4. How many identifying marks are left on a bullet by which police may trace a criminal? (See page 788.)
5. How does the Karolus cell make possible the transmission of telegrams in thirty seconds? Define the Karolus cell. (See page 789.)
6. What is the greatest height to which man has ascended into the atmosphere? (See page 791.)
7. How many feet higher will the road-bed of the new Hudson River bridge be in cold weather, due to shrinkage of the cables? How much nearer will the towers be to each other under full load conditions? (See page 792.)
8. How much moisture do you think there is in a cubic mile of fog? (See page 795.)
9. What is your idea of the appearance of the Metal Emperor? (See page 798.)
10. Can life actually be created by chemical means? (See page 806.)
11. What particular oils are liable to cause spontaneous combustion? (See page 812.)
12. What effect have changes in the sun's radiation on radio reception? (See page 825.)

# The Astrology Humbug

By JOSEPH H. KRAUS

In the October, 1926, issue of SCIENCE AND INVENTION Magazine this publication announced an Astrology Contest and offered $6,000.00 in prizes to any astrologer who would meet the contest conditions. The conditions follow herewith:

$5,000.00 will be paid to the astrologer or forecaster who will foretell three major events of such a nature that he will have no control over the outcome of the same. He must describe in advance each event in detail, giving the location and result or the casualties if the event is an accident.

$1,000.00 will be paid to the astrologer or forecaster who will produce three accurate, detailed and perfect horoscopes, free of contradictions on the lives of three people, whose initials will be given him when he requests the same and the birth dates and place of birth will also be supplied by this office.

Since that time, thousands of astrologers and others who did not profess to be astrologers have submitted horoscopes based on three individual characters whose names we furnished to those requesting them. These characters were subjects X, Y, and Z.

It was the editor's contention that even the astrologers themselves do not know whereof they speak. This statement on our part caused much controversy and unfavorable comment from the astrologers. Nevertheless, as a result of the analysis of these various letters from India, Turkey, Czecho-Slovakia, Germany, England, Ireland, China, France, Africa, Australia, countries in South America, the United States and Canada, not to exclude those few from Russia, Spain, Portugal, Italy, etc., we know definitely that our original statement, not made without investigation, must certainly continue to be held until such time as someone places astrology on a real scientific basis.

No, astrology is not a science.

Our letter which was identical in every case and which went to the various astrologers follows herewith:

*My dear Mr.———*

*In accordance with your request we are giving you the following data: Subject X, male, born November 24, 1851, New York City, 11:20 A. M. Subject Y, male, born July 26, 1870, 8:10 P. M., New York City. An important event to enable you to double-check this latter party's life occurred July 30, 1915.*

*Subject Z, male, born April 21, 1899, 6:00 P. M., in Brooklyn, N. Y. With regard to the important event mentioned in the second analysis, we would advise that this may be the birth of a son, of a daughter, a serious illness, a recovery from illness, a change of position, the receipt of a large sum of money, a divorce, a marriage, a second marriage, an accident, the loss of a limb, the loss of life, a trip abroad, enlistment into the service in the World War with a foreign contingent, an airplane accident, a train wreck or what not. You should be able to tell.*

*We will appreciate receiving the horoscope.*

Cordially yours,
SCIENCE AND INVENTION
Field Editor.

*J. H. Kraus*
*LP*

Now by way of information, subject X is a Catholic with four degrees from universities, a lecturer, a scientist and author of international repute, a man who loves his fellowmen, who, in spite of his age, is in wonderful shape physically, alert mentally, and influential socially. Dr. T. O'Conor Sloane's name and reputation will be found in "Who's Who."

Subject Y—a man implicated in a murder and on the date specified was executed at Sing Sing.

Subject Z died in infancy at the age of eighteen months.

Let us assume that our data is incorrect. Let us assume that the hour of birth given to the astrologers is not true. Let us suppose that we have picked any hour of any date for our subjects. It follows that in view of the fact that this same identical hour is sent to thousands of astrologers that those astrologers should give us the same kind of a reading. Does it not? If we submit a problem to the mathematics professors of the world, we will get the same answer, provided of course that the problem can be solved. The Russian professor will tell us that the ratio of the circumference of a circle to its diameter is 3.14159. The professor from England may carry this out a little further. The figure has been calculated to the 707th place, nevertheless, whether coming from America or from some foreign land, the ratio is identical and if the ten place figure is used, calculation on a curve with a radius of 100 feet would not err within a millionth of an inch.

Were we to ask an analytical chemist in New York City to analyze a product, his results would be identical with those of any other accurate analytical chemist in any part of the world. If we ask a physician as to the cause of a person's death, as indicated by an autopsy, we can be reasonably assured that his findings are correct and any subsequent autopsies revealing the same condition would produce the same inferences. And so it is of every other scientific pursuit.

While it is true that a physician cannot always tell us what is wrong with us, he has very little difficulty in telling others what had been wrong with us after he got down to his ultimate analysis, following the autopsy.

What is all this about you say. Well—we have given astrologers throughout the world the same identical facts, the same figures, and we get different answers. At no time did any one of the astrologers point out that the important event mentioned in our communication was an electrocution. Two of them indicated "that a violent death due to either illness or by his own hand, or the hand of another, resulted on that day." In these two horoscopes, the statements borne out concerning the important event were quite accurate, but those relating to other incidents in the lives of the three subjects were hopelessly inaccurate. Now then, let us take a few letters; just a few selected at random from all of those which we have on hand and quote those portions of the horoscope which we link directly to the important event occurring on July 30, 1915, which as stated before was the date of exe-

(Continued on page 862)

# MOTOR HINTS

Conducted by GEORGE A. LUERS

### WINTER STORAGE OF THE AUTOMOBILE

WHEN it is necessary to store the automobile for the winter, it is essential to take certain precautions. There are several things to consider. Cold, dampness and rodents.

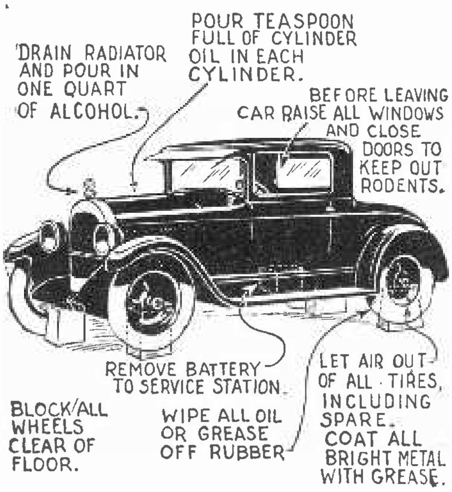
The car should be stored in a dry place, or as nearly dry as possible. All cracks or openings should be closed with burlap, or boards. Holes through which rodents will enter should preferably be closed with tin.

The battery should be removed to the house, for monthly charging, or to a battery service station.

The water should be thoroughly drained from the radiator and one quart of denatured alcohol poured into the radiator. The car should be set on bricks or props under the axles, and the air let out of tires not touching the floor, to take the strain off the casings. All grease should be removed from the rubber.

Place a spoonful of cylinder oil in each cylinder and turn the engine over to coat the cylinder walls and prevent rust.

With cup grease or vaseline, cover all bright metal surfaces, including the nickel, with a light coat.




**There are a few simple, yet worthwhile rules which should be followed in preparing a motor car for storage through the winter, and the main points to be watched and taken care of are shown graphically in the illustration above.**

If a closed car, raise all windows and close doors, as an extra precaution against rodents.

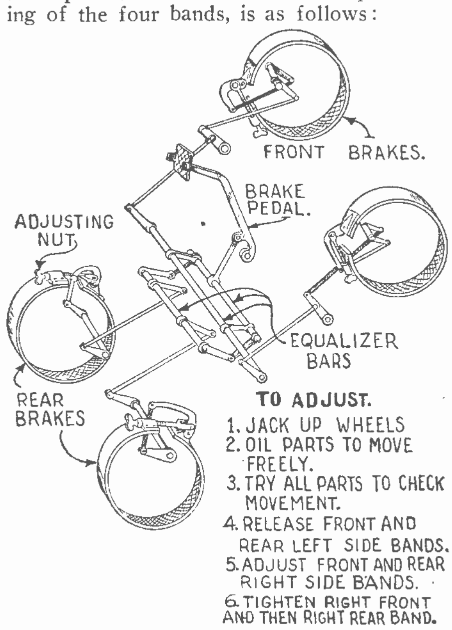
The car can be left, after these details are attended to, with assurance that it will be in good condition in the spring.

### ADJUSTING FOUR-WHEEL BRAKES

Any mechanical braking system, operating brakes on four wheels, depends for smooth operation and maximum braking effect upon —first, full and not too short pedal travel; second, action of parts in equalizers being well lubricated and free; third, clearance around the band of 1/32 inch, and fourth, all bands releasing and resting against the stops provided.

The sketch shows the main details of a four-wheel brake system. This is typical of the connections between the pedal and the brake bands.

To adjust the four-wheel brakes, the usual procedure which will insure equal braking of the four bands, is as follows:




**The method of procedure in adjusting four-wheel brakes is made quite a simple matter by Mr. Luers, with the aid of the chart herewith.**

(a) Jack up all four wheels and block as shown.

(b) Oil all parts of the brakes and rods which slide or move.

> **DO YOU KNOW—**
>
> **an engine in good and proper adjustment will use an appreciable amount of oil. If the supply in the reservoir does not diminish, it indicates gasoline dilution, water seepage into the crankcase, or failure of oil pump. Inspection and repairs should be made when the cause is found.**

(c) Move by means of the pedal and by hand, each rod connecting to a band to see that shafts and connections are free.

(d) Release the front and rear brake on the right side of the car, by slacking off the thumb nuts.

(e) Tighten up the front and rear brakes on the left side of the car, so each wheel offers the same resistance to being moved. To determine this point, set a block against the pedal, at almost full forward position. Grasp a wheel by its tire and move it with the force of your arms. Tighten or loosen, until equal resistance is obtained.

(f) Tighten the right front brake to the same tension or resistance and finally tighten the band on the right rear wheel and check to see if all bands are clear when the brake pedal is released.

### CARE OF UPHOLSTERY IN THE CLOSED CAR

The age of a closed car is judged by the condition of the upholstery, rather than through the speedometer. It is desirable to keep this fresh and new if the owner does not want rapid depreciation and a low trade-in value.

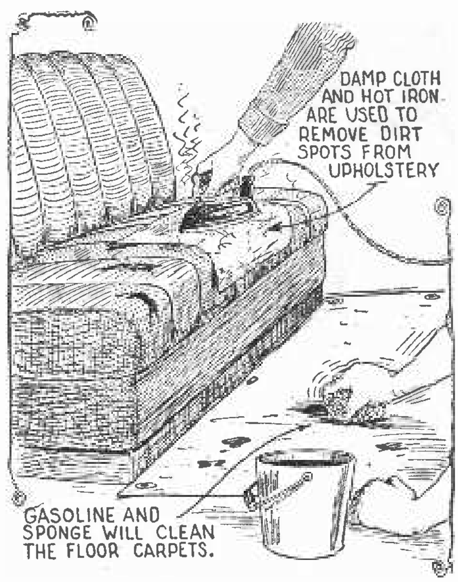
Closed cars can best be kept clean with a vacuum cleaner. Without a vacuum cleaner, the next best is a whisk broom. With this, brush the seats from the top down toward the forward edges of the seats, or in the direction of the weave of the fabric. Avoid brushing across the nap.

Ordinary spots are removed with a damp cloth and a hot iron, running the hot iron over the cloth laid on the spot. Do not leave the iron long enough to dry the cloth. If grease spots are to be removed, use ether, or one of the several commercial cloth cleaners. Use a wet cloth and hot iron afterwards to smooth out the nap.

Floor carpets are cleaned of spots and grease, with a sponge and gasoline, being removed for drying outside the car.

Avoid soap and water on any spots in the upholstering or the floor rugs, as it will make an ugly, conspicuous spot.

The inside of the car should be cleaned with regularity, as an accumulation of dust




**The automobile owner and chauffeur have to frequently clean the upholstery, and many useful hints are given in the accompanying article by Mr. Luers. Above, we see a simple method illustrated for removing spots from cloth upholstery.**

and dirt discolors the upholstery to such an extent that it cannot be removed after a long period of contact. This accounts for the dingy look of some comparatively new cars.

### INSTALLING STEERING KNUCKLE BUSHINGS

Play in the bushings at the front wheel steering knuckles contribute much to front wheel wabble or "shimmy." Wheels not on steady centers cannot be held from moving unsteadily and along with other renewal of parts these bushings should be renewed as soon as play or wear shows up.

To remove the old bushings, one of the simplest means is with the use of a tap screwed into the bushing and driven from the opposite side with a heavy pin or bolt.

*(Continued on page 858)*

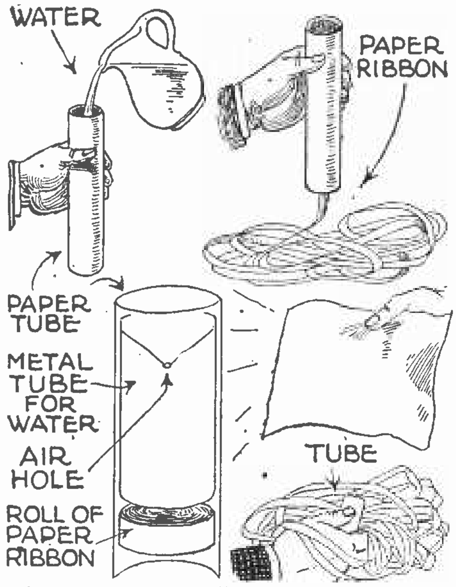
# MAGIC By "DUNNINGER"

NO. 58 OF A SERIES

## ENCHANTMENT

A sheet of cartridge paper, about 12" x 16" or square, either 12" or 16" on a side, is rolled into a tube. Some water is poured into the upper end of this tube, but contrary to general expectations, the water does not come through, the magician puts his finger into the bottom end of the rolled form, and starts to withdraw dozens of yards of paper ribbon. After the supply of paper ribbon has failed, he unrolls the paper tube to indicate that no water is present.

In producing this effect, a metal fake is used, as indicated in the diagram. This receives the water and at the same time serves as the hiding place for the roll of paper ribbon. The metal fake is rolled into the cartridge paper, is filled with water, the ribbon then removed, and while bundling the paper ribbon into the hand, the performer drops the fake containing the water into the folds of the ribbon. Thus, when he tosses the ribbon away, the fake is simultaneously thrown away in the bundle, whereupon the paper tube can be unrolled, proving it to be entirely empty.

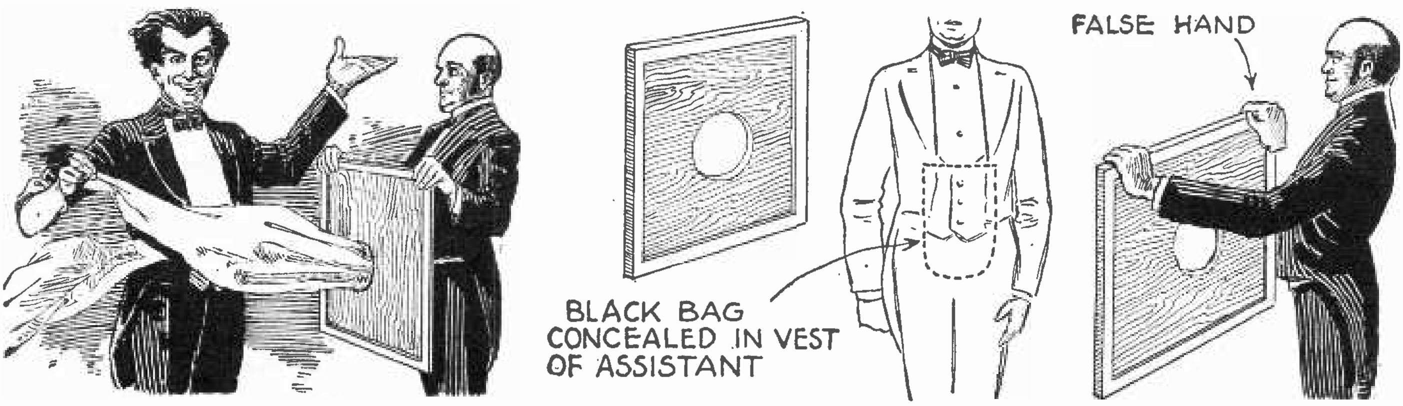



A piece of paper is rolled up in the form of a tube and water poured into it. A paper ribbon is produced from the tube which is then opened and shown empty. The secret is given in the accompanying story.

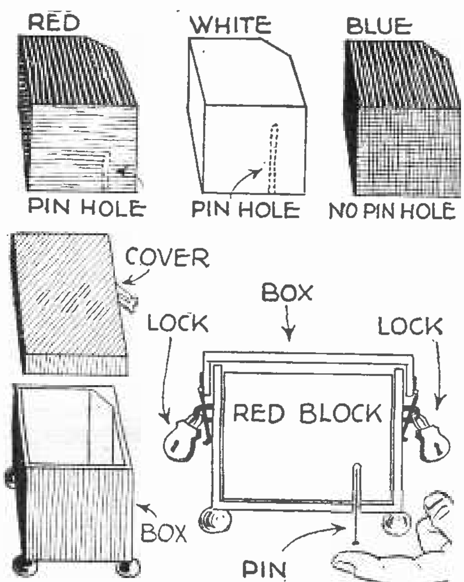
## THE BOARD OF PLENTY

The diagram below illustrates quite an effective trick known as the board of plenty. First, a board about 20" square and 1" thick is passed for examination. This is ordinary save for a hole approximately 6" in diameter cut out of the center. On being returned, an assistant is told to hold the board firmly between his two hands and at a considerable distance from his body. Reaching into the hole, the magician pulls forth yard upon yard of colored silk cloth, bunting, kerchiefs, flags, rabbits and any other articles desired.

The secret lies in the fact that the performer's assistant is very well loaded. In a deep pouch concealed beneath his vest, and extending well into the trousers, the various articles for the production are concealed. The magician himself cannot get at them without the audience getting unduly suspicious, so the assistant withdraws them from the pouch and holds them in readiness for the wizard. In order to hide the operation, a false hand is attached to the end of the board, leaving the assistant's hand and arm free.




This trick is known as the board of plenty. A board with a hole about six inches in diameter is passed for examination and upon being returned, is held by an assistant. Through the hole, the magician takes yards and yards of cloth, flags, rabbits and other incidental magic paraphernalia. Actually the assistant does the work with the aid of a false hand.



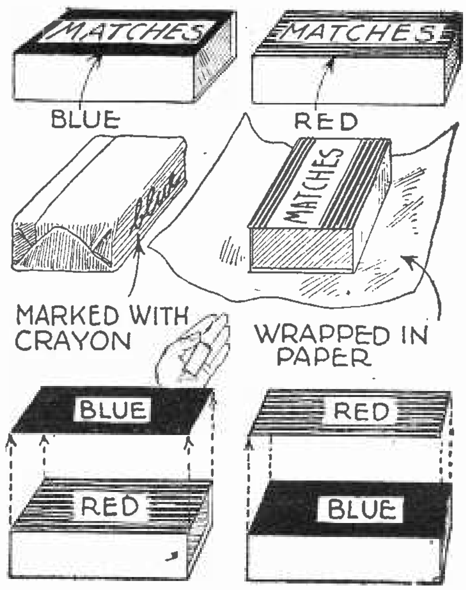

A red, a white or a blue block is put in a small box and then the cover is locked in place. Holding the box behind his back, the performer can instantly tell the color of the block. A pin and a drilled hole produce the effect.

## MYSTIC BOX TRICK

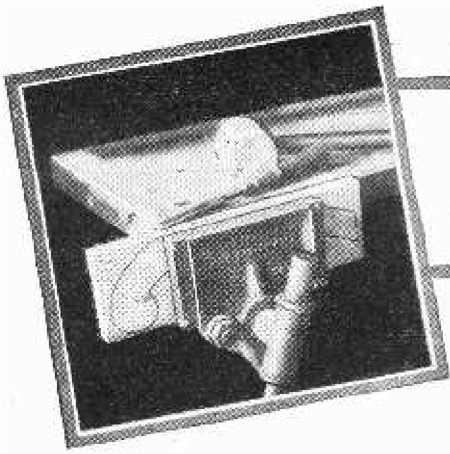
A small metal box is passed for examination and while the magician is absent, a wooden block is locked securely in the box. When he returns, the wizard holds the box behind his back and immediately calls the color of the concealed block. The answer to the problem, while entirely new to wizardry, is quite simple. Both blocks and box are so arranged that the block can enter the box in but one position. This position causes a hole in the bottom of the block to come in conjunction with another hole in the box. Inserting a thin pin, the magician can tell as to whether the block is red or white, because it can be pushed into the hole to different depths. It would be easier to locate the pinhole if the pin were made to penetrate through one of the feet of the box.

## PASSE-PASSE MATCH BOXES

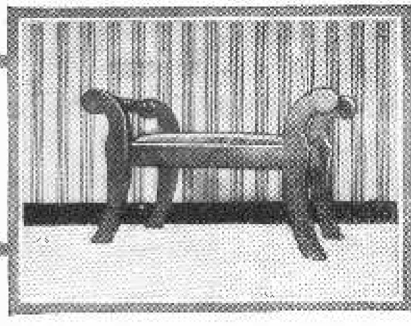
Two match boxes are shown, one with a blue and the other a red label. These are carefully wrapped in small squares of paper, and when unwrapped they will have changed their positions. The effect is produced by having duplicate tops of different colors attached to the boxes with beeswax. The tops are removed and palmed in the act of wrapping the boxes in paper.



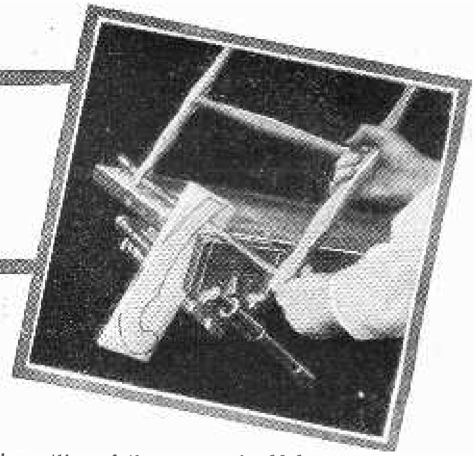

This trick is appropriately called the passe-passe match boxes. One of them has a red label, and the other a blue. When wrapped in paper and given to two assistants to hold, they exchange places.



Above: the leg ready for chiseling.



The finished Colonial type footstool is shown in the photograph above. It is sturdy in construction and will look well in either the living or bedroom. It not only makes an excellent foot rest but is ideal when used as a low fireside seat.

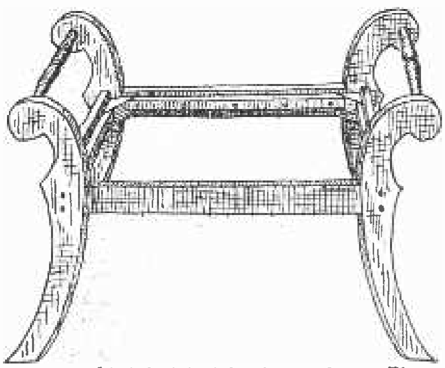


The outline of the curves should be cut with a hand saw.

# Building A Colonial Type Footstool

*By* H. L. WEATHERBY

THE footstool illustrated will serve a double purpose. It makes an excellent foot rest, and as a low fireside seat it will prove to be very much in demand. Its lines are good, it is sturdy, and it will decorate either living or bedroom.



The assembled footstool is shown above. The cleats to which the upholstery is tacked are also shown.

The material is all ¾″ thick. Mahogany or walnut, if available, will be most in keeping with the period that the stool represents. However, a good grade of poplar, or other soft wood with little grain, will stain and finish a very nice mahogany or walnut, and only the expert will be able to detect the difference.

Secure enough wood to make the number of pieces desired, of the sizes indicated. Hand plane the pieces for the legs before sawing them to shape or cutting the mortises. Next, lay out a cardboard pattern for the curve and mark around it on the four pieces. It is well, in laying out the mortises, to place the four edges of the leg pieces together and square across all of them at once. Now separate them and gauge the lines on the individual pieces lengthwise of the cut, with a line gauged through the middle of the layout in addition, to center the bit for boring.

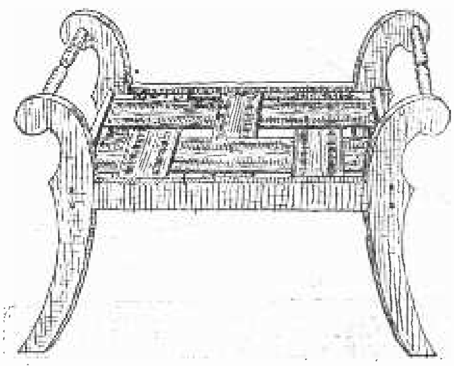
To cut the mortise, bore overlapping holes to a depth of ¾″ with a bit that is 1/16 smaller in diameter than is the width of the mortise. Cut down the edges and ends of the mortise with a sharp chisel. (Note illustration.)

The tenons are laid out together also, to insure accuracy, and fitted carefully to the mortises, using saw and chisel to cut the shoulders.

Having fitted the joints, we saw the curves on the leg pieces with a hand-turning saw as illustrated. Smooth these edges with spoke shave, file and sandpaper, rounding the corners ever so slightly.

A good grade of cabinet glue is necessary for our next step. Clamp together, with glue in the joints, the two pairs of legs with side pieces, and allow to set twenty-four hours before attaching the end rails. However, in the meantime, the corner blocks, rounds, and cleats may be prepared. The pieces for the rounds may be taken to the mill to be turned, or made by hand as illustrated.

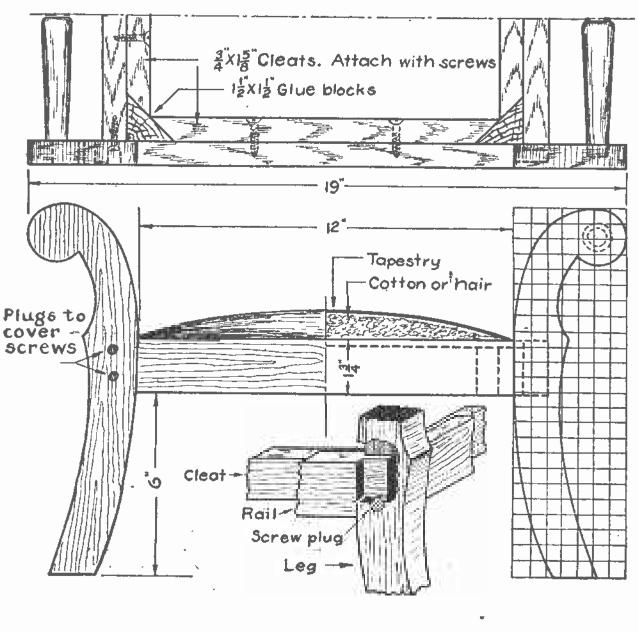
In preparing the corner blocks, take a 1½″ x 1½″ square piece of wood, that has been carefully planed square, about 8″ long, and draw a diagonal line across one end. With a



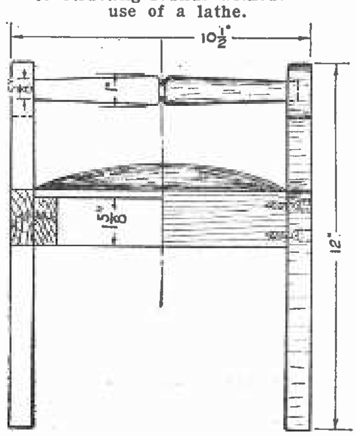
The webbing is woven to provide added strength and is held in place with carpet tacks driven into the cleats.

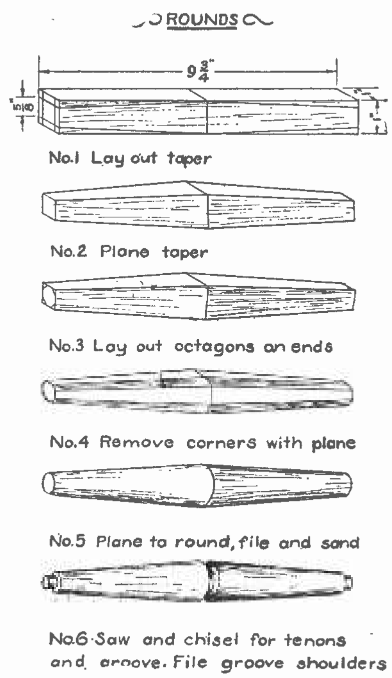
handsaw, cut down the length of the block diagonally, making two triangular pieces which can be cut into blocks of the right length.

(*Continued on page* 868)




The details and dimensions of the footstool are given in this illustration. The material is all three-quarter inches thick and mahogany or walnut should be used if available. The drawing at the right-hand side of the illustration shows the method of constructing rounds without the use of a lathe.

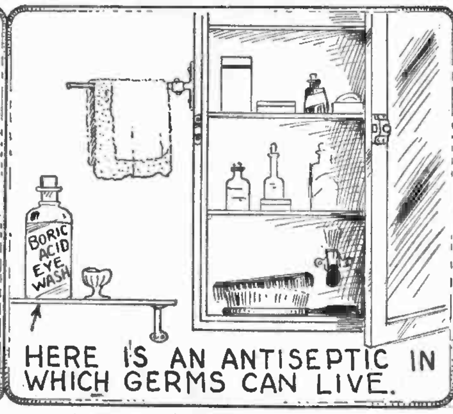


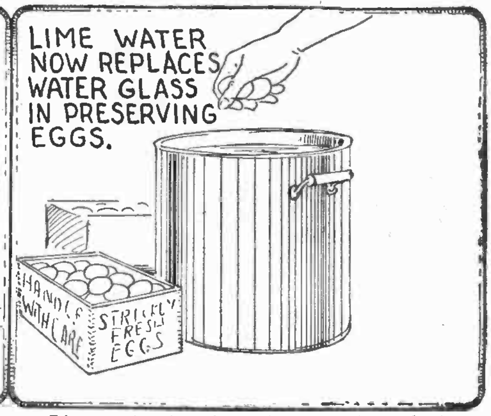
# Everyday Chemistry

By RAYMOND B. WAILES

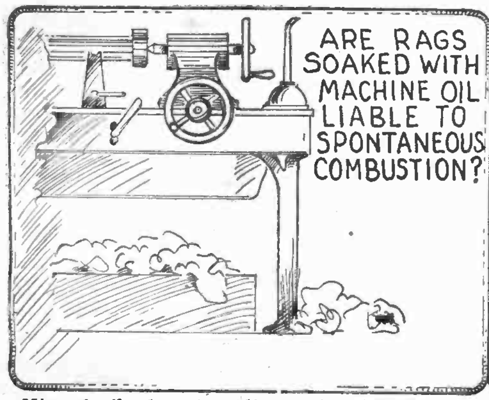

Water dissolves many substances but is itself dissolved when gelatin is added to it.



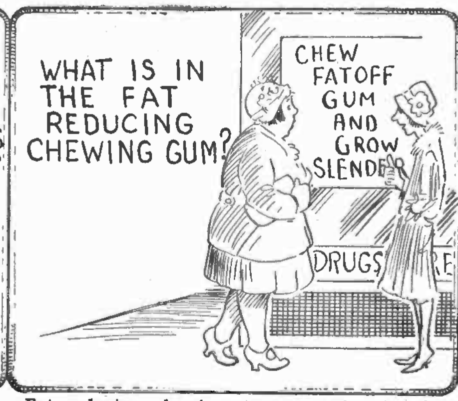

Certain bacteria (torula) have been found to live in boric acid solution, used as an antiseptic.



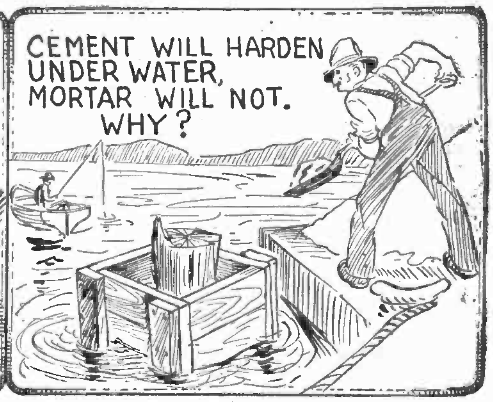

Lime water has been found to be a better egg preserver than water glass. It does not turn the shell brown.



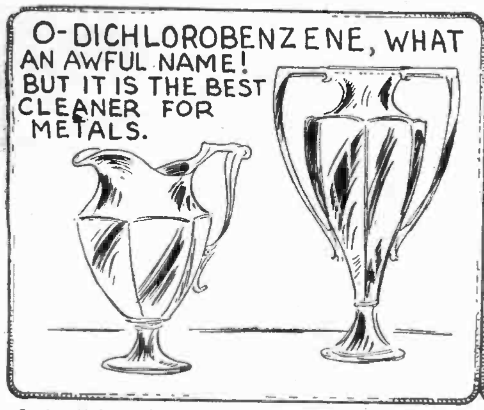

Mineral oils do not readily oxidize but drying oils unite with oxygen and may ignite spontaneously.




Fat reducing chewing gums contain phenolphthalein and their use is not advocated by doctors.

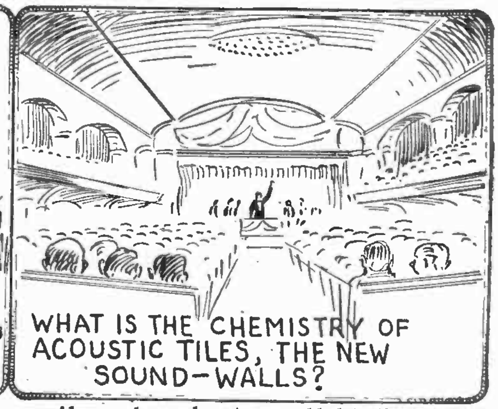



Mortar requires carbon dioxide from the air in order to set, cement does not.




Ortho-dichloro-benzene has just been found to be a very good cleaner of metals.

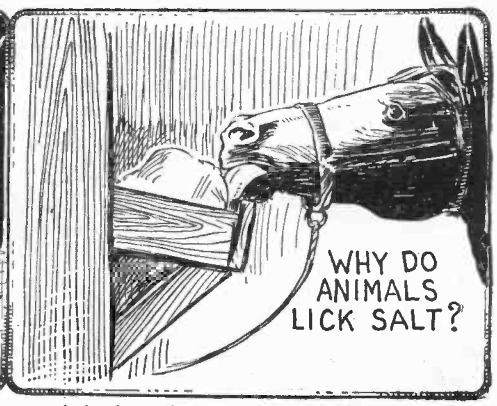

Benzine and lye remove the paint, but starch is added to prevent the benzine from evaporating.




Alum and a carbonate are added to the mortar and produce carbon dioxide gas cells.


Spring water contains dissolved chemicals which effectively lower its freezing point.


Rain and snow dissolve nitrogen-bearing gases from the atmosphere which are assimilated by the plants.




Animals eating non-meaty foods which contain potash also require a certain amount of sodium.

# Solving Ship Power Secrets With Models

## Engineering Experts Use Washington Model Basin As a Proving Ground for Ship-building

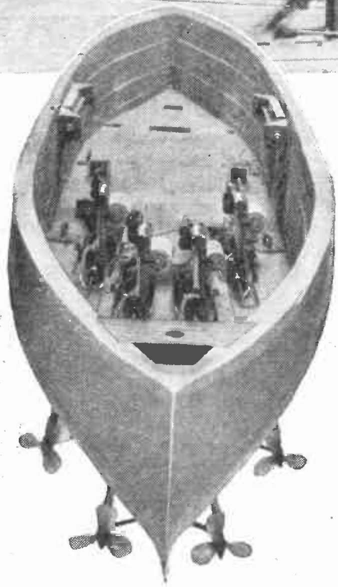
*By* G. H. DACY

Towing carriage at end of run. Wave-making mechanism in the foreground at the model basin.

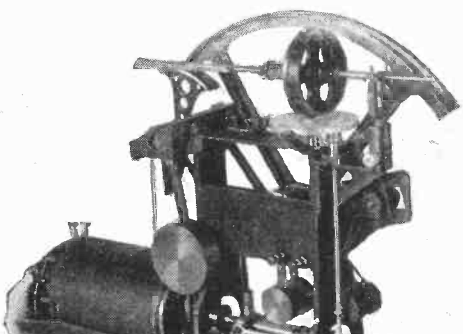
TIN ships that ply the waters of science's greatest swimming pool at the Washington Navy Yard solve the secrets of ocean liners and mighty seafaring craft and add standardization to the maritime industry.

Uncle Sam tests miniature models of battleships, liners, submarines, cruisers and pleasure yachts in a mammoth indoor pool to determine their power requirements, frictional resistance and other facts about their operation efficiency. Mistakes which might otherwise be made in the building of big ships are prevented as a result of these interesting experiments with "toy ships."

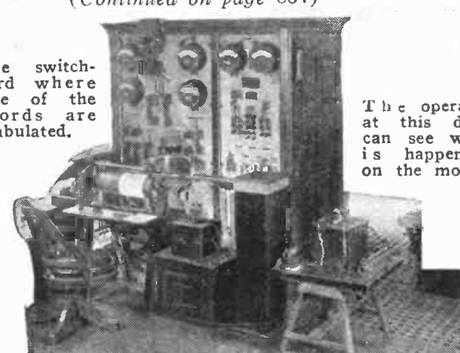
(*Continued on page* 864)



The above photograph shows a ship model equipped with motors, propellers and recorders which is used in the model basin to tell the engineers all of the little factors necessary for the speed and safety of its larger counterpart. Eventually this model will be built up in scale to a full size vessel.

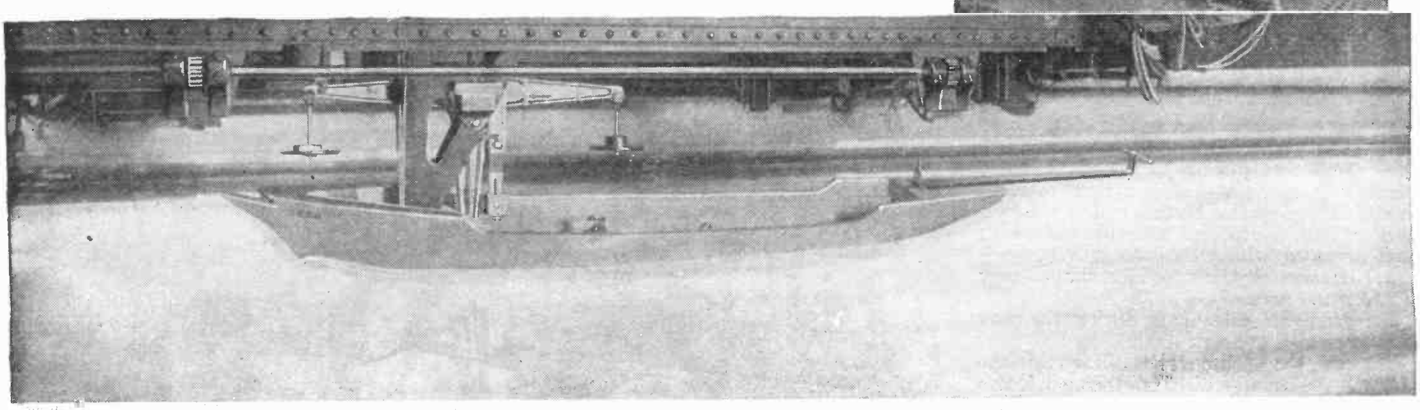


Here is a recorder used on the little ships that run by their own power plants and small motors.



The switch-board where some of the records are tabulated.

The operator at this desk can see what is happening on the model.



Yacht model under test in the Navy Yard basin. The model is in position under the carriage. This model is being towed in an inclined position to represent the effect of side pressure from the wind on the sails. Its full size reproduction will then have all the advantages which modern engineering skill can give it.

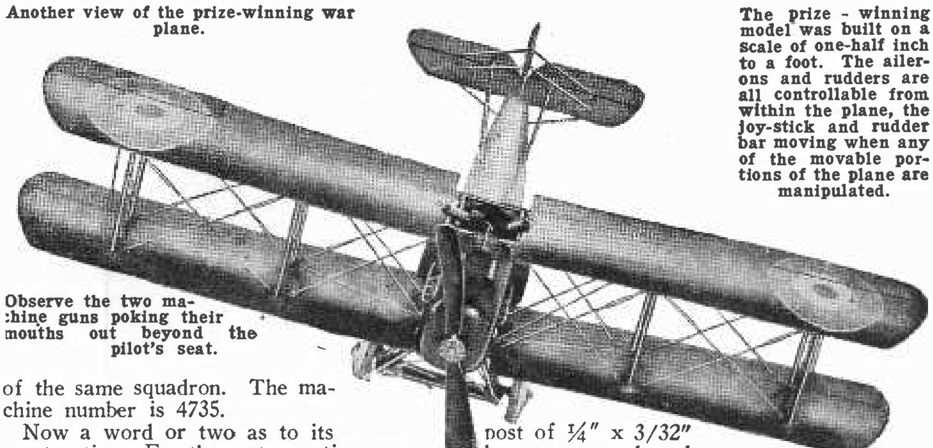
# MODEL DEPARTMENT

# Metal Airplane Wins S. & I. Trophy

**Miniature Model is Constructed by Aviator Who Flew This Type of Plane. This Month's Winner is Robert S. V. Elliot, of Brooklyn, N. Y.**

## Rules for Model Contest

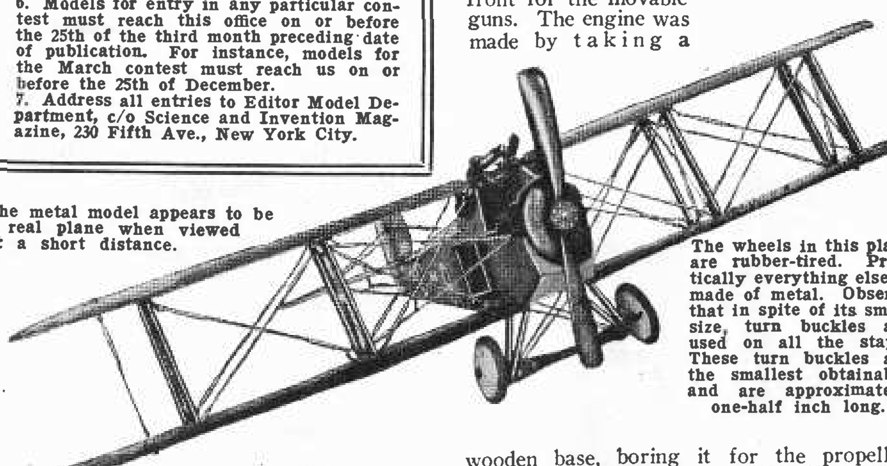
1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against drainage in shipment and sent to us by parcel post, express or freight prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the March contest must reach us on or before the 25th of December.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 230 Fifth Ave., New York City.



Another view of the prize-winning war plane.

The prize - winning model was built on a scale of one-half inch to a foot. The ailerons and rudders are all controllable from within the plane, the joy-stick and rudder bar moving when any of the movable portions of the plane are manipulated.

Observe the two machine guns poking their mouths out beyond the pilot's seat.



The metal model appears to be a real plane when viewed at a short distance.

The wheels in this plane are rubber-tired. Practically everything else is made of metal. Observe that in spite of its small size, turn buckles are used on all the stays. These turn buckles are the smallest obtainable and are approximately one-half inch long.

THIS month the SCIENCE AND INVENTION trophy cup is awarded to Robert S. V. Elliot, of Brooklyn, N. Y., for his remarkable little model of a British Sopwith Dolphin Model 5F1. The original plane was motored with a 250-horsepower Hispano Suiza motor, of the eight-cylinder, water-cooled type. The water-cooling system was necessary because the plane was used at a height of from 15,000 to 25,000 feet. The scout plane was armed with two Vickers machine guns, synchronized to shoot between the propeller blades, and two Lewis machine guns which were movable and which were provided with guards to prevent accidental damage to the propeller should they be aimed too low.

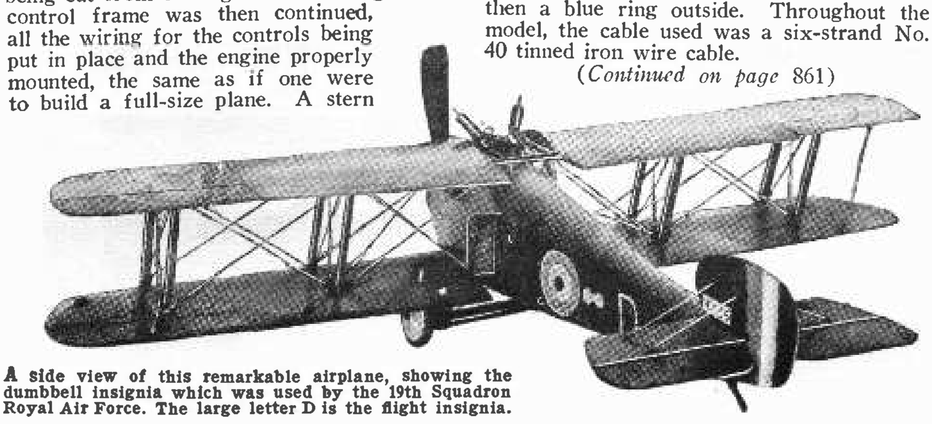
The range of this plane during the war was three and one-half hours.

One of the photographs indicates the squadron insignia, which on this particular plane is a dumbbell representing the 19th Squadron Royal Air Force. The D on the side of the plane indicates the flight insignia of the same squadron. The machine number is 4735.

Now a word or two as to its construction. For the center section, one-eighth inch tubing was used, soldered together with lugs drilled for the strut sockets, and the bands were put on the front for the movable guns. The engine was made by taking a wooden base, boring it for the propeller shaft, which was a one-eighth inch bolt, shaping sheet brass for the cylinders and tacking the brass in place. The fixed guns were mounted on the engine, and the exhaust tubes were soldered to the cylinders after being cut from one-eighth inch tubing. The control frame was then continued, all the wiring for the controls being put in place and the engine properly mounted, the same as if one were to build a full-size plane. A stern post of 1/4" x 3/32" brass was shaped and drilled for the tail skid spring, after which the tail skid was assembled and fitted. The fuselage was then made of sheet brass, drilled for the controls, and the radiators soldered to the two sides. The top of the fuselage was likewise shaped and soldered and after the control wires had been pulled through, the bottom was soldered in place. The under carriage was next assembled and then soldered to the fuselage, rubber bands being added for shock absorbers and the wheels tired with umbrella rings. The wings, tail plane, rudder, etc., were made of sheet brass, with a one-eighth inch tube, soldered to the top in the top planes, and to the bottom in the bottom planes for control wires. Hinges, of course, had to be cut for the ailerons and holes drilled for the pins. The propeller was made of wood and the guns of copper nails. The instrument board was then made of a sheet of brass, the back of which was inscribed and half punched through for the instruments. A similar action produced a sheet metal seat.

All the painting was done before erecting. The top and side surfaces were given a dark green coat. All the bottom surfaces are ivory colored, the propeller, a natural mahogany, and the wheels also ivory. The insignia has a red center, then a white and then a blue ring outside. Throughout the model, the cable used was a six-strand No. 40 tinned iron wire cable.

(Continued on page 861)

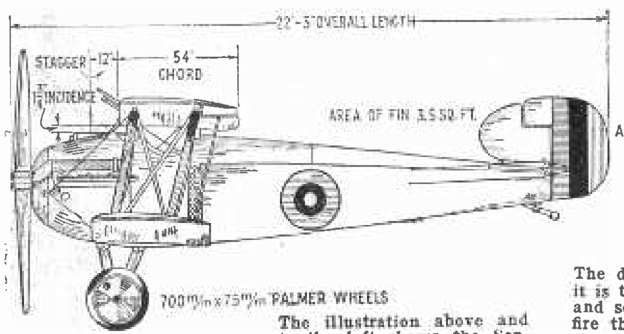


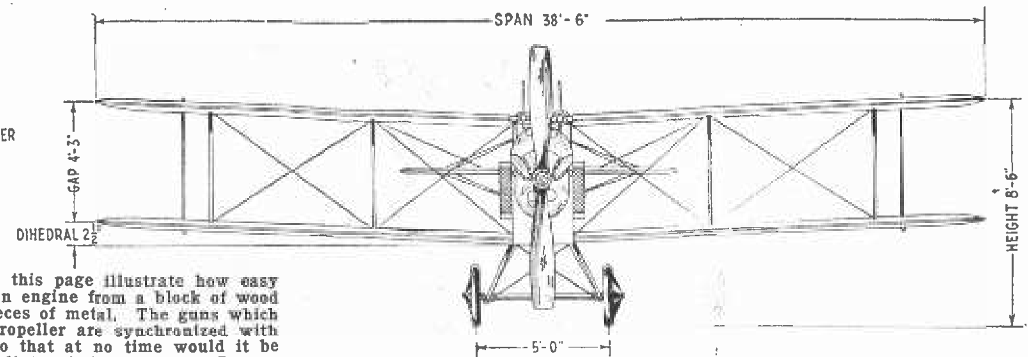
A side view of this remarkable airplane, showing the dumbbell insignia which was used by the 19th Squadron Royal Air Force. The large letter D is the flight insignia.

# Details of the Prize-Winning Airplane Model

**200 Horsepower Hispano Suiza Sopwith Biplane, Type 5F1, Wins SCIENCE AND INVENTION Trophy**

**Robert S. V. Elliot, a War Veteran, the Winner**



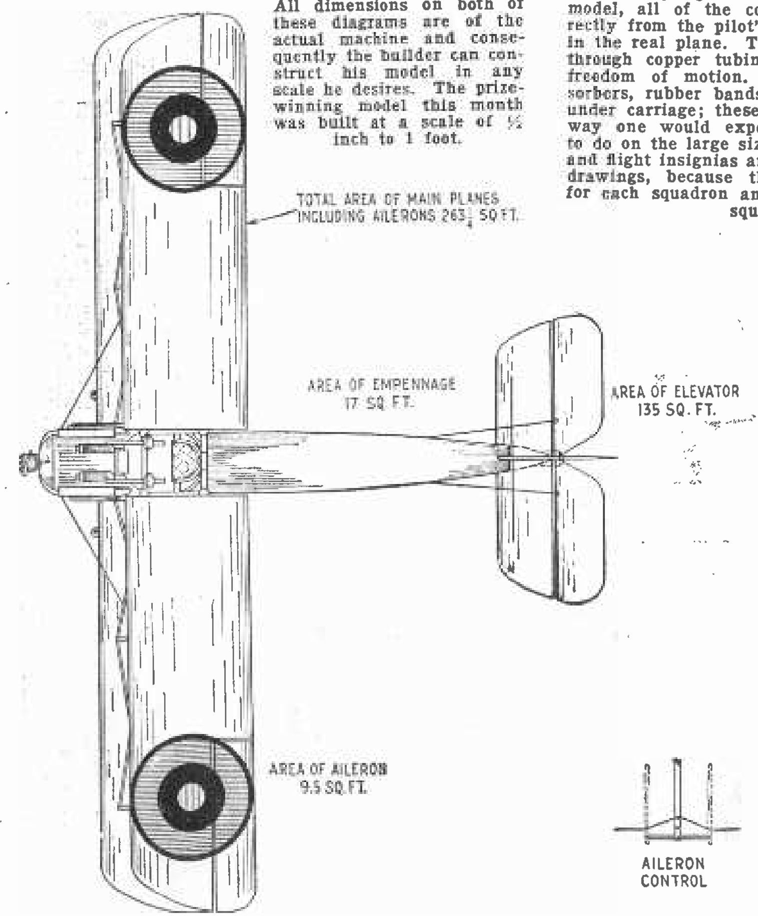



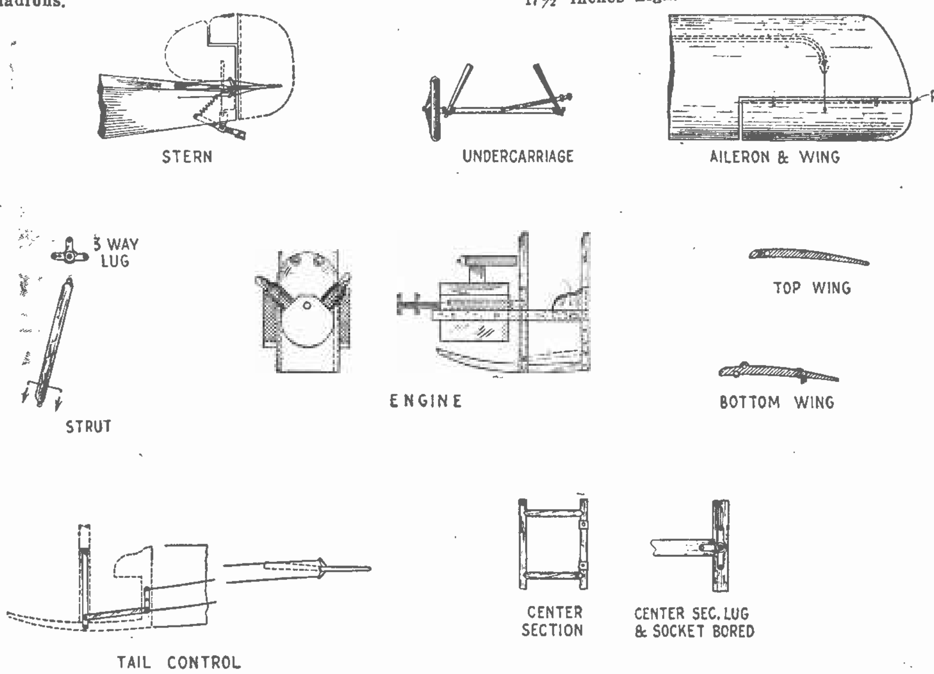

The illustration above and to the left shows the Sopwith Biplane, Type 5FI. All dimensions on both of these diagrams are of the actual machine and consequently the builder can construct his model in any scale he desires. The prize-winning model this month was built at a scale of ½ inch to 1 foot.

The details on this page illustrate how easy it is to build an engine from a block of wood and several pieces of metal. The guns which fire thru the propeller are synchronized with the propeller so that at no time would it be accidentally splintered by a shot. In the model, all of the controls are operated directly from the pilot's seat, just as they are in the real plane. The control wires are led through copper tubing, curved to permit of freedom of motion. Instead of shock absorbers, rubber bands were employed on the under carriage; these bands act in the same way one would expect the shock absorbers to do on the large sized plane. The squadron and flight insignias are not indicated on these drawings, because they would be different for each squadron and for the various flight squadrons.

Every month SCIENCE AND INVENTION Magazine awards a large silver loving cup, suitably engraved, for the best model which is entered in the Model Contest. In the previous page the reader may find the rules of this contest. All models not winning a cup are returned to the builders, as are those which actually win the prize award. Every care is taken of the model so the contestant need not fear for its safety. We respectfully urge all model enthusiasts to submit their models of airplanes, locomotives, steam engines, gasoline engines, sail-boats, motor boats and models of ancient or futuristic mechanisms to the Editors of the Model Department, in competition for this lovely cup. The award is certainly worth winning.

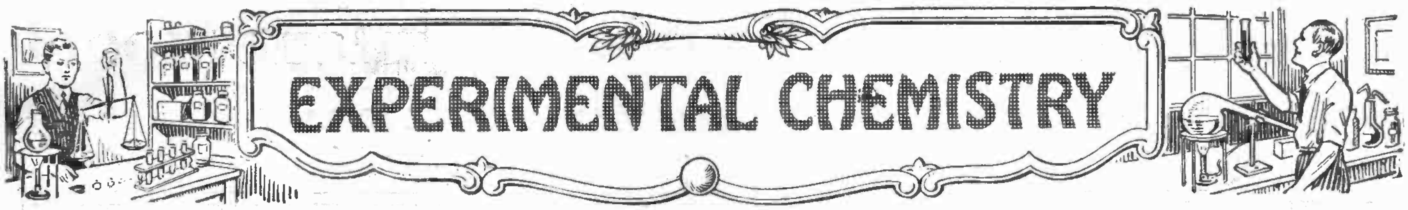
Remember that the cup weighs approximately five pounds and stands 17½ inches high.




**200 HP. HISPANO SUIZA SOPWITH BIPLANE TYPE 5F1**

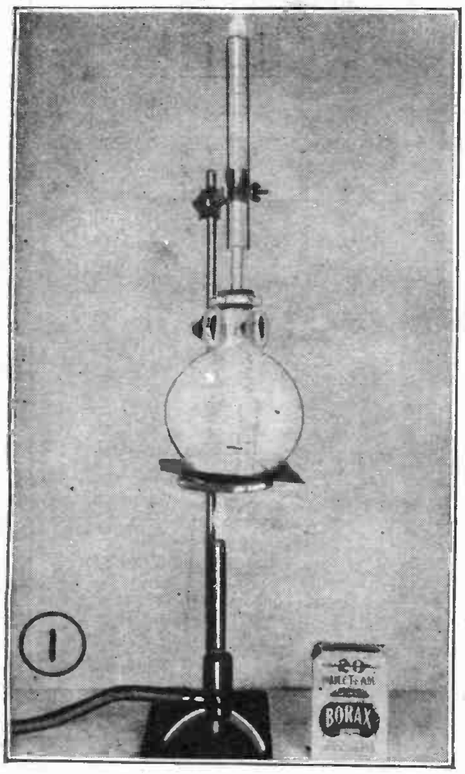
SCALE ½" = 1'-0"




# Simple Chemical Analyses

*By* RAYMOND B. WAILES

HOW would you feel if you learned that you had paid half a dollar for a nickel's worth of borax? Many are doing that today, for the majority of material for making hair washes



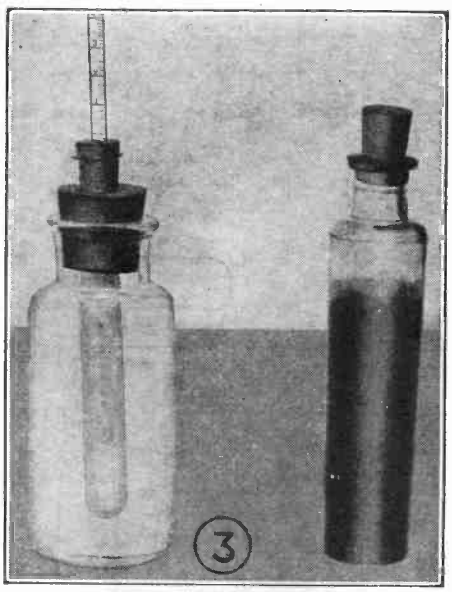

An interesting test for the presence of borax, involving the production of a green-colored flame. As the green is rather feeble, the edges of the flame should be watched to see it.

at home sold in powdered form at the corner druggist, is nothing but borax, or contains about ninety percent of borax. A fancy name plus a fancy box equals a fancy price.

With the simple apparatus as shown in the photograph you can determine whether a substance contains a borax or boron compound. The round bottomed flask is fitted with a stopper carrying a half-inch glass tube about two inches long. Over this is slipped a three-quarters of an inch in diameter glass tube about four or five inches long. Place the substance to be tested, using several grams, in the flask, with about twenty-five cc of alcohol and five cc of strong sulphuric acid. Rubbing alcohol will serve. Heat the flask and then light the vapors which issue from the top glass tube. If they burn with a bluish green flame, borax is present in the flask. Watch the edges of the flame to see the color. The object of the larger tube is to provide a stack through which the vapors pass from the flask, and in so doing, suck in air as does the Bunsen burner, thus forming a good combustible mixture.

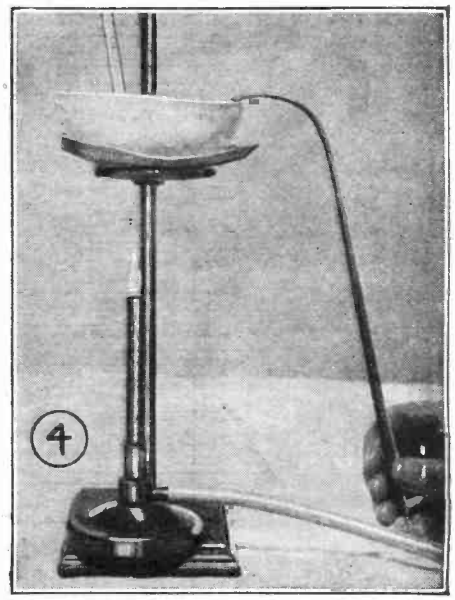
The exhaust of the automobile usually contains carbon monoxide. The writer has found from two to seven percent carbon monoxide in the exhaust gases of three popular makes of automobiles when analyzed with an apparatus designed for that purpose. You can determine whether the exhaust gases contain carbon monoxide (CO) by making an ammoniacal solution of silver nitrate and exposing the solution to the gas. If carbon monoxide is present, a discoloration of the solution will occur. Make two tubes of silver nitrate solution and add carefully, several drops of strong ammonium hydroxide. Keep adding the alkali until the precipitate first produced has just gone into solution again. Stopper one of the tubes and keep it as a reference standard. Use the other tube as shown in the photograph. Dilute blood, obtained by pricking the finger with a sterile needle, can also be used instead of the silver nitrate solution. It will turn pink in color if carbon monoxide is caused to act upon it.


A number of people have been killed by carbon monoxide gas from automobile exhausts. Here is a simple test for the gas.




A very interesting test to give the relative oxidizing characteristic of oils, so essential when used as a vehicle for paint.

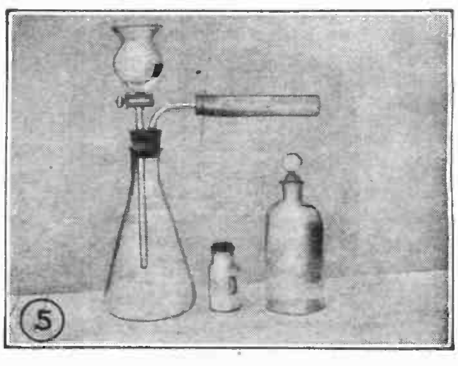
Mineral oils, such as lubricating oil, do not generally cause spontaneous combustion, for they do not oxidize or readily combine with the oxygen of the air. Animal and vegetable oils do and when absorbed by clothes, wiping rags, waste or other absorbent carriers, the oxygen of the air oxidizes them and raises their temperature to the kindling point.




The flash-point and burning-point of petroleum oils, such as kerosene, determined by a very simple experiment.

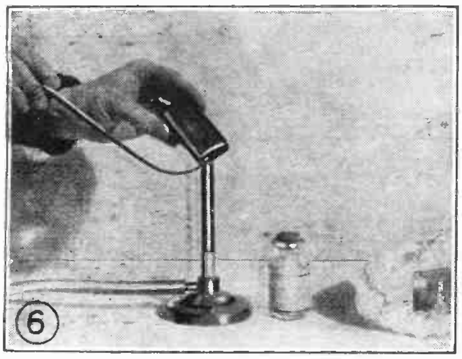
You can test the oxidizing power of different oils by placing a measured amount in a test tube containing a thermometer and some absorbent cotton. Place this test tube in a wide mouth bottle and immerse the bottle in hot water at about 80 degrees. The oil which produces the greatest rise of the thermometer has the greatest power to oxidize or start spontaneous combustion. Always use the same amount of oils in making the tests, and keep the water bath around the bottle at the same temperature for every determination.

The flash point and burning point of oils can be determined by the amateur chemist with the simplest of apparatus. Take a sample of the oil and place it in a porcelain evaporating dish and heat it very slowly with a Bunsen burner. An accurate ther-




A version of the famous Marsh test for arsenic, of great simplicity.

mometer should be immersed in the oil so that the entire bulb is covered. Now connect an ordinary brass mouth blowpipe with a rubber tube and this tube in turn to the gas supply. Adjust the gas so that a flame a quarter of an inch long or less burns at the end of the blowpipe. As the oil becomes slowly heated pass the minute flame across the surface of the heated oil. The temperature at which a flash of flame forms on the surface of the oil, is called the flash point of the oil. As the oil becomes hotter, the flash of flame will become a steady flame and the oil will burn steadily. The temperature at which combustion starts as noted by the thermometer, is called the burning point of the oil.




**Testing "tin foil" to see if it is really tin or aluminum. A great deal of so-called tin foil, contains none of the metal.**

To test for arsenic in a compound, place a sample of the substance in a flask, add pieces of pure zinc, a crystal of copper sulphate and pure dilute (1:4) sulphuric acid. Pass the issuing gas over a piece of cotton cloth soaked in mercuric chloride solution and afterwards dried out. If the dried cotton becomes colored during the test, arsenic is present. The photograph shows a convenient means for holding the cloth while the gas is passing thru it. It is contained in a glass tube which is stoppered at one end with a one-holed stopper which in turn is thrust over the exit tube of the flask.

The metallic foil usually wrapped around chocolate bars, photographic films, tobacco, cigarettes, tea, etc., is generally called "tin foil." Sometimes it is tin foil, but then again it may be aluminum foil, lead foil or a special alloy. To determine if it is aluminum, or to determine aluminum in substances, proceed as follows: Dissolve the

(*Continued on page* 866)

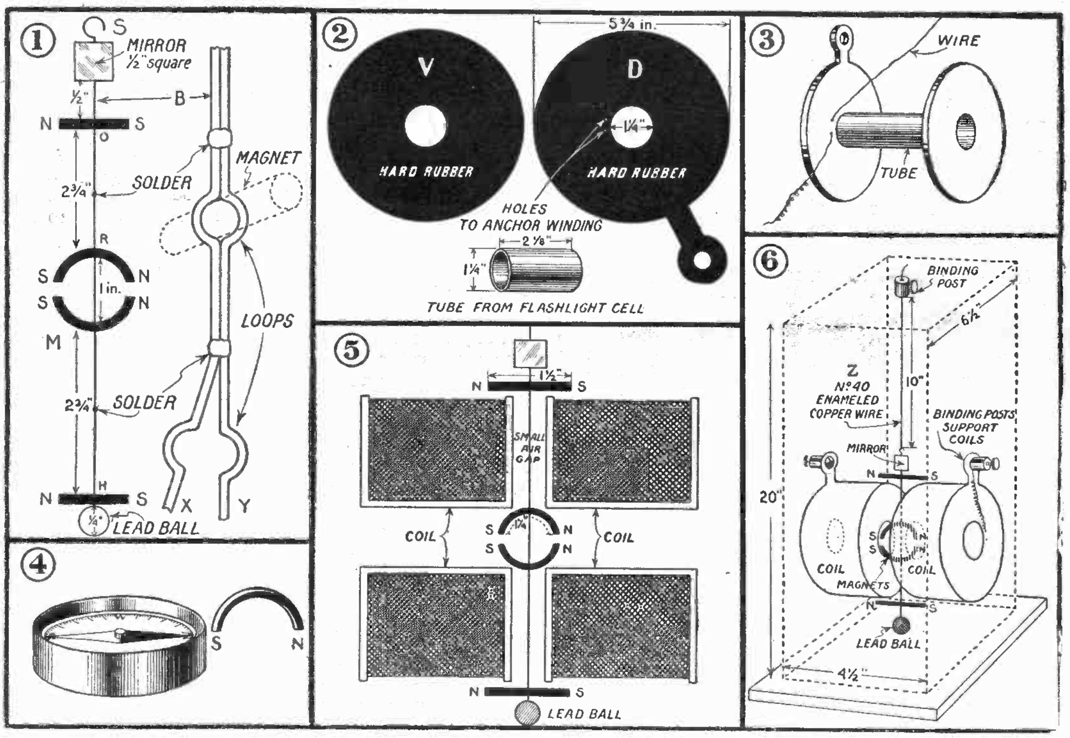

**Testing tea for tannic acid and tannates. The test really makes ink.**

# Ballistic Galvanometer

***By* LOUIS TOTH**

THIS is a special form of galvanometer, used for measuring extremely small currents, such as are induced in a conductor if the current in a neighboring conductor is started or stopped, or if a magnet be moved in the vicinity; it is also very useful in testing photo-electric, selenium, or other light sensitive cells.

The magnetic system of this galvanometer is constructed so as to have considerable weight and the magnets are so arranged that the earth's field has hardly any effect on the magnetic system; that is, one half of the magnets are arranged so that their field opposes that of the remaining half.




**The ballistic galvanometer is an instrument of great delicacy and is indispensable in many investigations in electricity, especially where currents of extremely short duration are concerned. The description is given in full in the article, but the illustrations above are practically self-explanatory and indicate the simplicity of construction.**

All this is shown clearly in Fig. 1. The support B for the magnets and mirror is put together as shown; the busbar wire X and Y should be square; as this is much easier to handle than the round.

The wires should be held together while the hook S is being formed 1 in. below this hook the first loop O is formed; 2¾ in. below the first the second loop R is formed; 1 in. lower the third and 2¾ in. below the third the last loop H is formed. These loops should be just large enough to securely hold the magnets used.

After all the loops have been formed a small lead ball is soldered ¼ in. below the last loop.

The magnets can be made from a knitting needle; two pieces 1½ in. long and two 1¼ in. should be cut. After cutting they are heated a cherry red, immersed in oil and agitated violently to harden them. Before hardening the two shorter pieces they should be bent into a half circle as shown at M.

Next a small square piece of mirror is glued to the upper end of the system directly below the hook S.

The magnets are now magnetized and inserted in the proper loops with polarities as shown; the polarities can be ascertained by bringing each one near a compass as shown in Fig. 4; a north pole will repel a north pole of the compass and attract the south pole. The coils are wound next. The materials required for the coil form are shown in Fig. 2; D and V are turned out of hard rubber or wood. There is a paper tube from a flash-light cell shown.

The complete assembly of the coil form is shown in Fig. 3. D and V are slipped over the edges of the tube and are glued as near the ends as possible. Holes are punched in the pieces D and V to anchor the wire as shown in the figures.

Two of these forms will be needed; they should be wound full of magnet wire; this will give a strong field at the center. The completed instrument is shown in Fig. 5 and 6. Z is a piece of No. 40 enameled copper wire on which the system turns. The terminals of the coils lead out to the binding posts on the sides of the cabinet. The front of the cabinet may be enclosed with a pane of glass, or with heavy cardboard if a small opening is left in front of the mirror, so that light may impinge upon it.

# THE CONSTRUCTOR

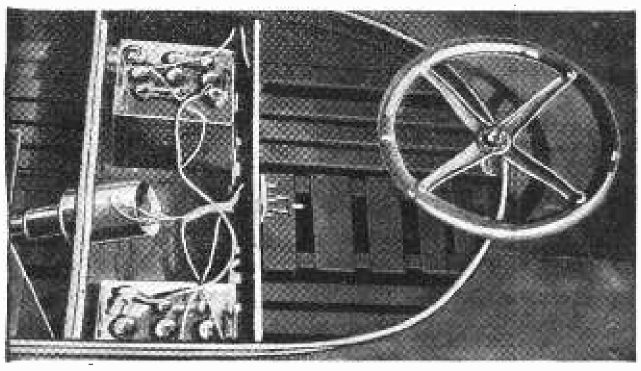
*Articles of Interest to the Home Mechanic*

# An Electric Kiddy Boat

## Two Storage Batteries and an Automobile Starter Drive Boat at Seven Miles for Fourteen Hours with Single Charge

**The above photograph shows a small eight-foot electric boat which can be operated by the youngsters and which will run backward and forward at the will of the operator. The boat is absolutely safe, inasmuch as it is driven by storage battery power.**

A SMALL electric boat, which will travel at seven miles per hour, is the latest fun-maker for the young folks. In this boat the motive apparatus consists of two ordinary storage batteries, preferably the 100-ampere or the 120-ampere types, and a small electric starter, such as the one used on a Ford motor. This starter does not consume as much energy as some of the larger types, and it has, therefore, been used in the construction indicated on this page. With its use and with the batteries fully charged, the boat will give continuous operation for fourteen hours before it is necessary to recharge the batteries. It will thus be seen that an entire day's sport could easily be obtained from the apparatus here shown and if one lives near the shore or can take the batteries home to be recharged, the cost of charging amounts to from 8c to 12c, depending on the cost of electrical energy to the consumer, or, in other words, less than a cent for every hour the boat is operated.



**This photograph shows the layout of the electric boat, the reverse switch being indicated in front of the driver's seat, which has been removed to show the batteries and the motor. Note that the motor is directly coupled to the shaft.**

The boat itself is eight feet long and made of wood so arranged that it will accommodate the driver and another person in the back seat. The storage batteries are then located beneath the pilot's seat and connected to a double-pole double-throw switch in front of this seat. With the switch in its central position, the current to the motor is shut off. When the switch is drawn up to the top, the boat moves forward, and when pushed down, the motor operates the propeller, causing the vessel to back-water. The only difficulty in a construction of this nature is the opening of the proper leads to the starter so that it can be made to operate in either direction. On this page will be found the diagram for properly connecting the automobile starter to run in either direction. The shaft of the motor is then fitted with a collar, which is in turn directly coupled to the propeller shaft. The propeller shaft fits in a piece of tubing properly packed at the top and bottom to prevent the entrance of water into the body of the vessel.

If the ship itself is long enough, it may not even be necessary to tightly pack the lower end and the top end of the pipe in which the propeller shaft fits, as the propeller shaft housing can be made to rise within the boat to a point higher than the water level of the boat. With a long tube there is little danger of water seeping into the boat except when backing.

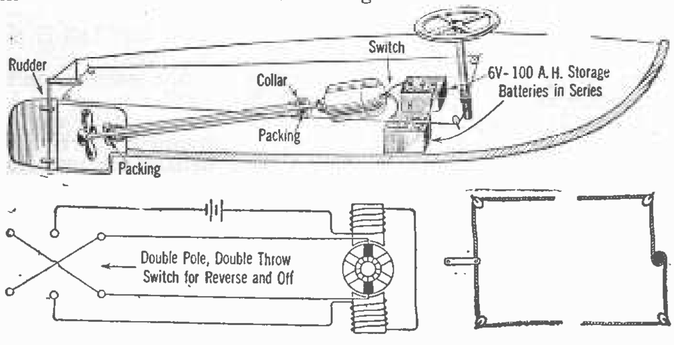
Such an electrically propelled boat is excellent for both trolling and for duck hunting. It makes practically no noise as it glides through the water and if fitted with a rheostat can be made to proceed at a very low rate of speed. If desired, the builder may put an automobile horn in the front of the vessel as is indicated in the photograph on this page or may substitute that horn with a searchlight. The control for either may be in the form of a switch or push button. An automobile steering wheel will serve as the wheel for steering this vessel. Its combination wood rim and metal spider produces the effect of a speed boat. This wheel is connected with a tiller coupled to the rudder post. A thin cord wound around the shaft of the wheel operates the rudder.

There is no doubt but that a mechanism of this nature is ideal for the youngsters. There is no danger from a gasoline fire, there is practically no danger of stalling the boat as long as there is energy enough in the batteries and the switching connections are in good working order. There is less possibility of the starter failing than there is of a gasoline engine failing. While the boat cannot produce extraordinary speeds, it does produce speeds ample for trolling, hunting and cruising. The mechanism can be operated by any woman or child whether mechanically inclined or not. For greater speeds and greater cruising range, it might be advisable to substitute a heavier starter motor and more storage batteries.

The vessel shown in the photographs on this page was built by Messrs. Mushet, Wager and Baxter, of Long Beach, Calif., who are trying this scheme out with the intention of renting similar articles on bays or inland lakes.

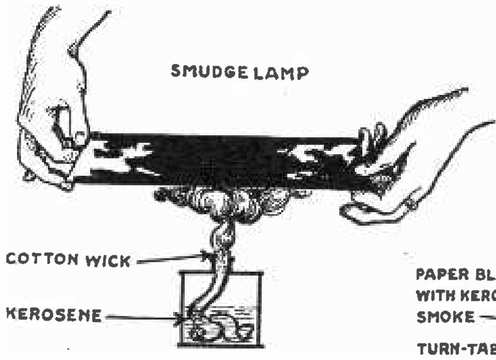
A boat of this nature eliminates all danger from gasoline fire and will not stall as long as there is enough energy in the batteries to keep it running. With the batteries fully charged the boat will give continuous operation, as we have stated above, for about fourteen hours, which makes it very economical to run. The hull is about eight feet long and will accommodate two persons. The storage batteries are placed out of the way beneath the pilot's seat. The cost of construction is relatively small when compared to the amount of pleasure which will be derived from its use. It should appeal to the hunter and fisherman as it is practically noiseless in operation and if a rheostat is provided the rate of speed may be varied at will. If desired, a searchlight may be mounted upon the front of the boat for use at night.

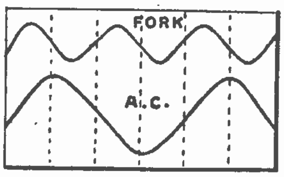
**The diagram at the right indicates the connections for the reverse switch for the electric boat and also shows the position of the batteries and the starter motor. The steering control is indicated diagrammatically at the extreme right. This boat when built develops a speed of a little more than seven miles an hour, which is quite remarkable for a vessel of its size and small powered driving apparatus.**

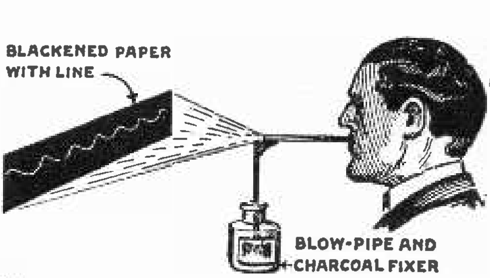


# Making An Oscillograph

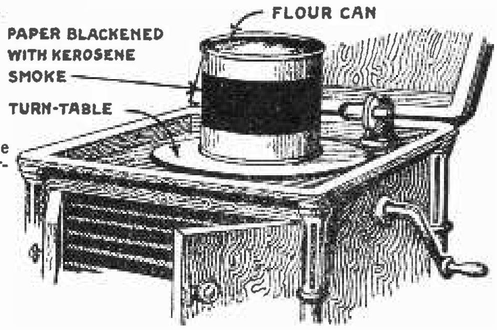
OSCILLOGRAPHS may be made at home at a small cost and will provide many interesting hours of experiment for the scientifically inclined. The process used is relatively simple. A piece of white paper is first given a coating of lamp black over a kerosene lamp as shown. This paper is then fastened around the circumference of a large tin can or some other suitable drum. The drum is placed upon the turn table of a phonograph and is allowed to revolve while the stylus is held against it, thus producing an oscillograph such as shown in the illustration. Oscillographs of the vibrations of tuning forks can be made by cementing or tying a straw marker or other suitable stylus to one leg of the fork. The fork is then made to vibrate and the marker held against the blackened chart paper. The illustration shows the method used in attaching the stylus to the leg of the fork. An oscillograph of a tuning fork having a physical pitch of 128 vibrations has been reproduced here. By attaching a stylus to the reed of a Baldwin phone, a graph of alternating current at various frequencies can easily be produced, an example of which is illustrated here. After the graph has been made, it should be sprayed with a charcoal fixer by means of a blow pipe. This preserves the graph which would otherwise become smudged over because of the lamp black used in coating the paper. The charcoal fixer is a mixture of alcohol and cochineal. Oscillographs of this nature can be made in a little time and should prove to be of interest to the scientific student or amateur experimenter. The electrical student will find this device very helpful.

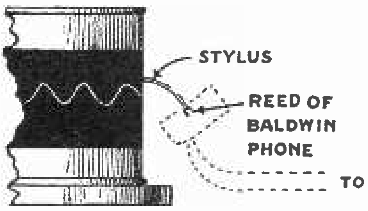


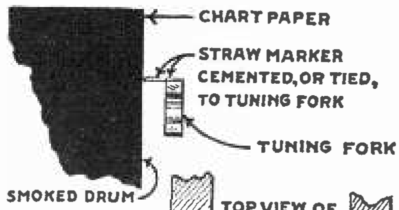



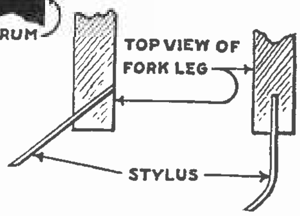

Above is the method used in blackening the paper. Below, making oscillograph of alternating current.




Above, at the top, is an oscillograph made from a tuning fork having 128 vibrations per second. Directly above is shown the method used in revolving the drum, which is placed upon the turntable of a phonograph. The finished graph should be coated with a charcoal fixer as shown.



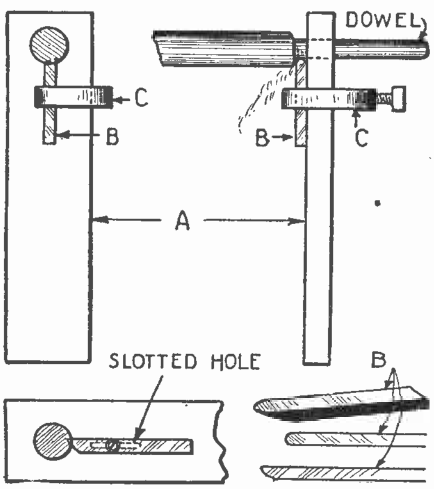




Above we see the method used in attaching a stylus to the leg of the tuning fork.

# Hints for the Mechanic

## DOWEL CUTTER

**FIRST PRIZE $10.00**



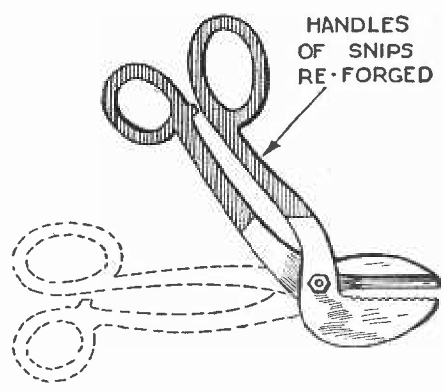

Details of the dowel cutter are shown above.

The diagram given above shows how the dowel cutting machine is constructed. A bar of iron or steel A is drilled to accomodate the dowel to be cut. The cutting tool B is fastened below the center of the hole. For temporary use it may be held in position by a clamp C. A permanent arrangement can be had by drilling a hole in the tool and making a slot in the bar, to allow for adjustments.—*Darwin Harris.*

### A New Department

MECHANICS' needs have caused us to start this new department—"Hints for the Mechanic," in which we intend to publish wrinkles useful to mechanics in general. You can help us with this department by writing a brief description of your favorite shop wrinkle and sending this to the editor of this department, together with a pencil or pen and ink sketch of the wrinkle. The ideas published herewith will give you some idea of what we want. Our draughtsmen will make the necessary mechanical drawings, so you need not send us finished drawings. We will pay $10.00 each month for the best Wrinkle or Hint sent in; others published will be paid for at space rates. Address all letters to Editor, Hints For the Mechanic Dept., in care of this magazine.

## TIN SHEARS



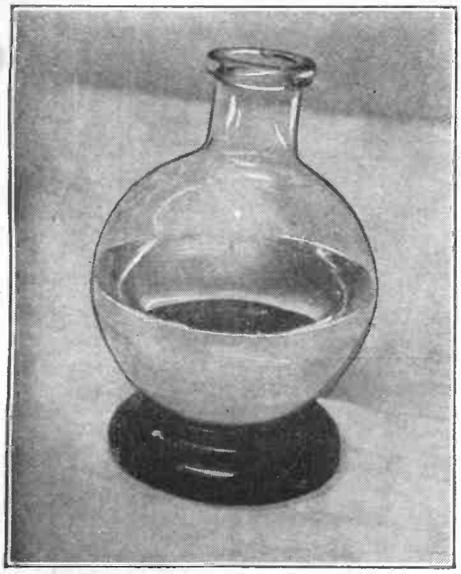

The above illustration shows the original shape of the tin shears, and after reforging.

Shears, reforged to the shape shown, will be found to be easier to use and more rapid in their action than the straight type. The handles are re-forged or bent just below the joint as indicated. A non-slip saw edged bottom will also prove a help. The hands are always protected when using these shears.—*W. S. Fogg.*

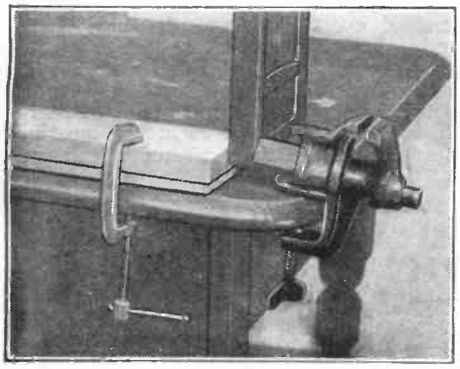
(*Continued on page* 864)

# Kinks for the Shop and Laboratory

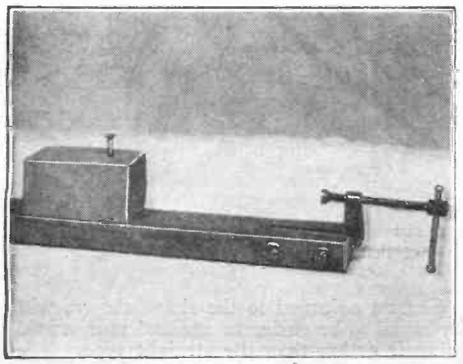
By RAYMOND B. WAILES



Sometimes it is quite difficult to know what to do with a round bottom flask when experimenting with chemicals. An ordinary large sized, wooden caster-well, which may be purchased from your local hardware store, makes an ideal support for such an object. These caster-wells come in different sizes and a few of the larger and smaller sizes will be sufficient for all needs.

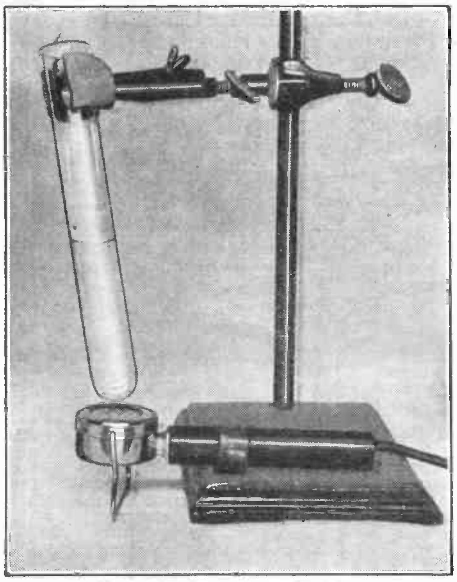


When gluing picture frames, joints, ship and model parts, etc., difficulty is sometimes encountered in keeping them in place. An ordinary bench vise, when properly arranged, makes an ideal holder. Loosen up the jaws, place the work next to the back movable piece and then clamp a block to the table against the work, by means of a C clamp as shown. Tighten up on the vise and leave over night.

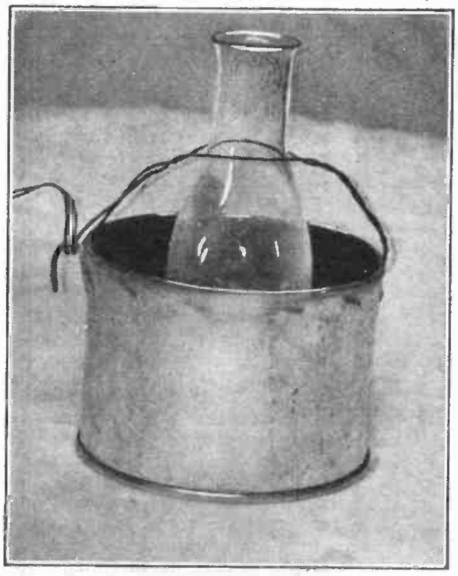


Another handy glue press can be made as follows: A strip of board has holes perforated along its center. This serves to hold the wooden block shown in the picture by means of the large nail. The work is placed between the block and the jaw of the C clamp, which has its lower jaw cut off. Two bolts hold the clamp in the center of the wood.

## Some Good Hints for Your Home Laboratory Are Illustrated on This Page.

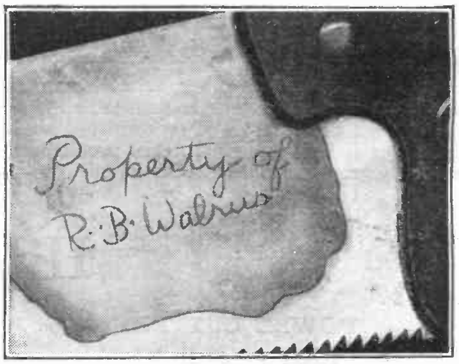


It is often desirable to have a means of heating test tubes, etc., when experimenting with chemicals. Sometimes it is difficult to make the necessary gas connections for using a Bunsen burner. An electric cigar lighter which is sometimes sold for half a dollar may be easily adapted for this work. The method is clearly shown in the illustration. A clamp stand is arranged to hold the test tube and the cigar lighter is set directly below, on the base of the stand.



A shallow tin can in the bottom of which have been placed some stones, makes a good water bath for low temperature reactions in the chemical laboratory. A twisted copper wire soldered to one side of the can, passing around the neck of the flask, and then twisted to a hook on the opposite side, will keep the flask stationary. A piece of paper placed in the can, will give off a burning odor which serves as a warning when the can goes dry. This bath is particularly adapted for experiments in which it is necessary to keep the chemicals at a constant temperature.

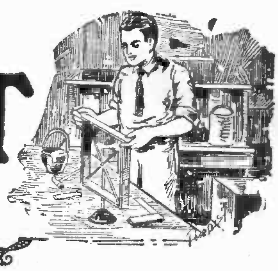
A flame spreader, or fish-tail attachment as it is sometimes called, is a handy addition to a Bunsen burner, when it is to be used to heat a small soldering iron. The use of the fish-tail in this manner distributes the heat evenly along the iron, so that the whole copper section of the "iron" is heated to the same temperature.



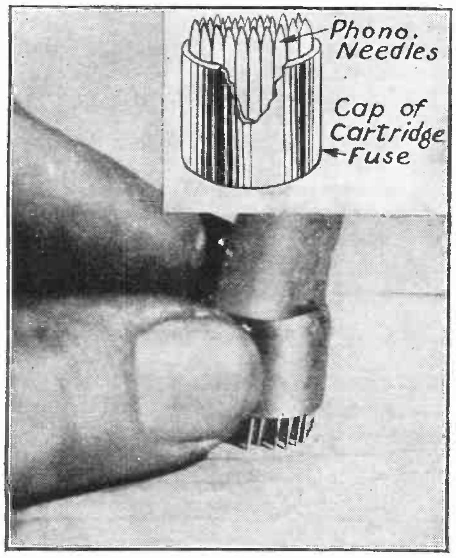

You can mark your tools, instruments and apparatus with your name, by first coating the place where the name is wanted, with wax. Heat the tool slightly so that the wax flows evenly. When cold, scratch your name through the wax, then apply a mixture of two parts of muriatic (hydrochloric) acid and one part of nitric acid. Allow to stay on about ten minutes and then wash off and remove the wax.

A hand drill is very useful in drilling holes in soft metals and wood, but if holes of a somewhat larger size are to be drilled. the drill must be given more pressure than can be obtained with the hands. The wooden block shown here, gouged out to fit the handle of the drill, converts the hand drill into a breast drill. The wooden block serves as a breast plate.

# HOW TO MAKE IT

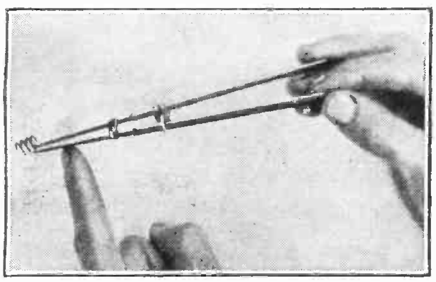


## STIPPLING TOOL



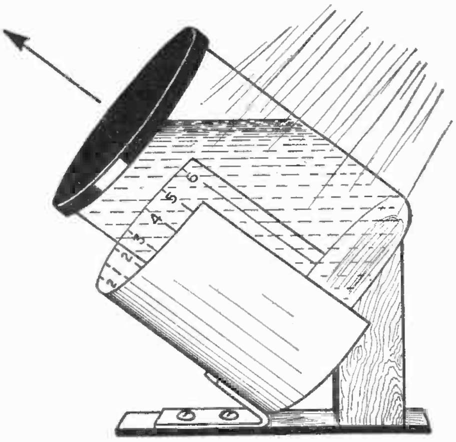

A handy stippling tool can be made from a cartridge fuse cap and a number of phonograph needles soldered in place as shown.
—*R. B. Wailes.*

## "HANDY PICK-UPS"



Above is a set of "pick-ups" made from two small flat files, having a rubber band placed between the ends and a fulcrum.
—*F. W. Bentley.*

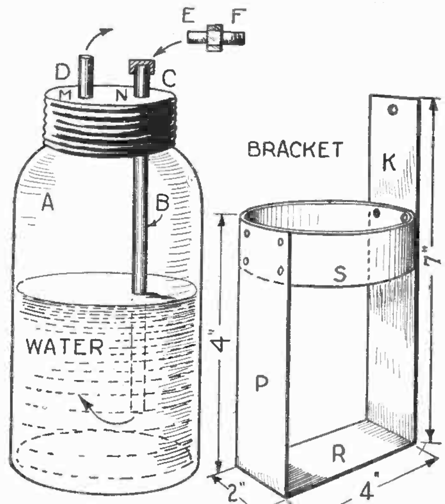
## SUN CLOCK



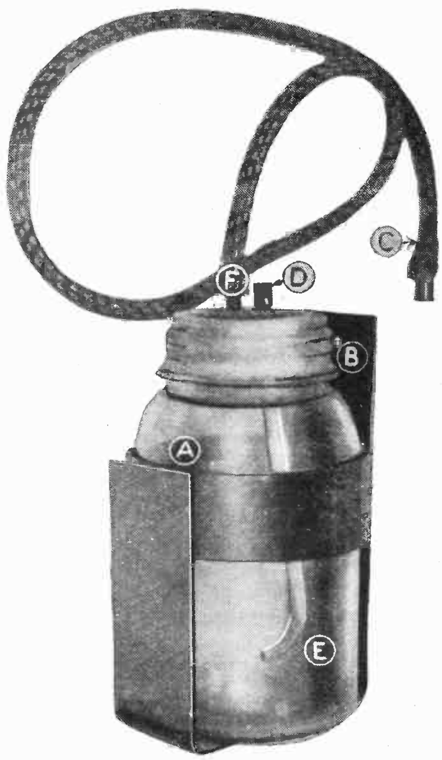
A novel sun clock can be made from a piece of sheet metal and a glass jar as shown. The jar is mounted parallel to the earth's axis. The sunlight, shining through the jar, is focused on the dial, giving correct time.
—*L. M. Shumaker.*

## WATER VAPOR CARBURETER

Good combustion depends upon a proper supply of oxygen. With the device used here, maximum power is obtained and carbon is practically eliminated. The water vapor cabureter feeds oxygen laden moisture to the intake manifold.—*Claude P. Fordyce.*

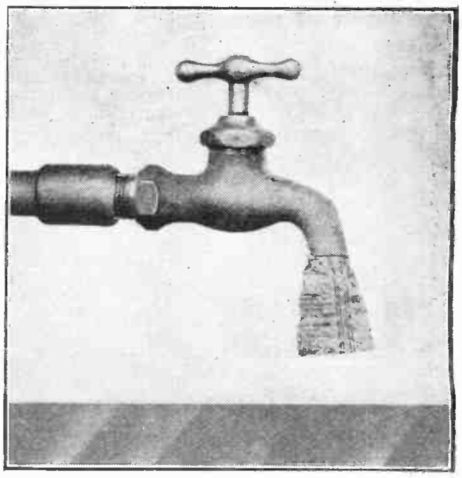



Details of the water vapor carburetor are shown in the above illustration. The outfit consists of a quart mason jar, a copper tube, a pet-cock, and a length of rubber tubing, all assembled as shown above.



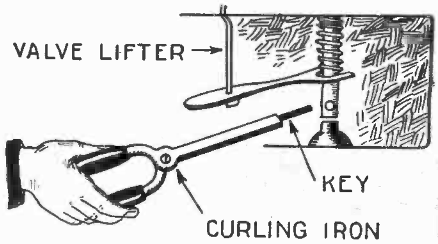

A photo of the finished vaporizer is shown here. It is controlled from the driver's seat and feeds moisture to the intake manifold, where it mixes with the gasoline vapor. The jar is held in place with the metal bracket shown above.

## FAUCET KINK



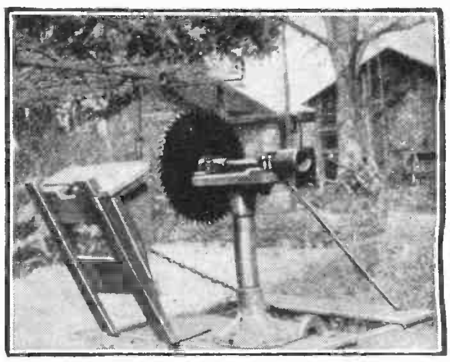
To make a faucet throw a thin sheet of water, cut off the end of a heavy paste tube, compress one end of it and squeeze the other end tightly around the mouth of the faucet. Very useful when washing photographic negatives or prints.
—*F. W. Bentley.*

## VALVE KEY REMOVER




A curling iron can be used to great advantage when removing the key from automobile valves. This simple apparatus not only removes, but replaces valve pins perfectly. It can also be used to retrieve small articles from inaccessible places. The method of using the iron is shown above.
—*C. Riser.*

## SAW STAND



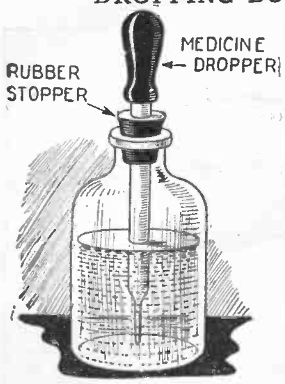
A section of a discarded rear axle housing makes a strong pedestal for an emery wheel, saw or similar tool. The end of the housing next to the wheel should be cut off with a hack saw, so that it may be bolted to a piece of board. Photo shows this device.
—*F. D. Ayres.*

# WRINKLES

## RECIPES & FORMULAS

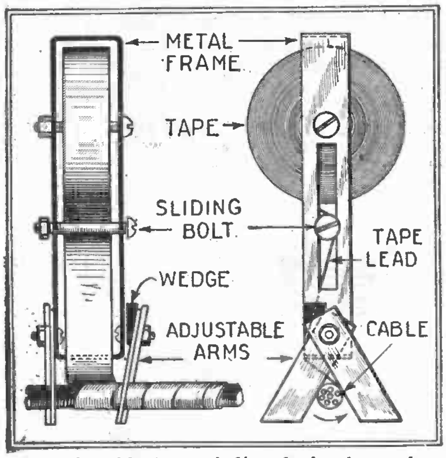
**Edited by S. Gernsback**

### DROPPING BOTTLE




A simple dropping bottle can be easily made by inserting a medicine dropper in a cork or rubber stopper and placing it in the bottle. The bottle should be short enough, so that the tip of the dropper will reach to the bottom of it. This simple device will find many uses in the laboratory and in the home.—Darwin Harris.

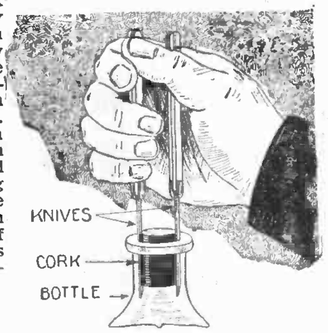
### TAPE WINDER




An adjustable tape winding device for applying cloth tape evenly and quickly is shown in the drawing above. The winder may easily be adjusted to any size and when complete measures about eight inches long.—Alton L. Dorr.

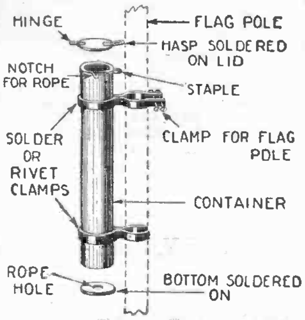
### CORK REMOVER

A tight cork may be easily removed from a bottle by employing the simple expedient shown in the drawing. Two thin knives such as are used for paring vegetables are inserted on either side of the cork as illustrated.—L. J. Wolfe.

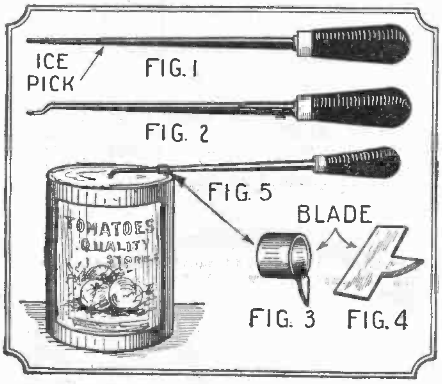



### FLAG CONTAINER

A novel flag container which is waterproof as well as theft-proof can be made from a piece of leader pipe, as shown. To operate, pull down outside rope to raise flag, and inside rope to lower flag into container. The flag is attached to the inside rope. —F. J. Wilhelm.

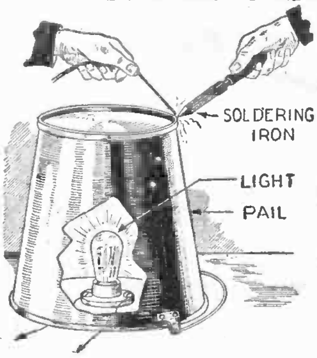



### CAN OPENER



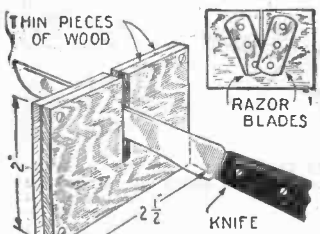

An inexpensive can opener may be made from an old ice pick with the end flattened out as shown in Fig. 2. This is fitted with a small blade affixed to the pick as shown in Fig. 5. The blade is made from a piece of sheet metal.—T. W. S.

### SOLDERING KINK




Holes in pails and metal containers may be easily soldered, in as much as they are made visible, by placing an electric light bulb inside of the inverted pail. All the holes will then be seen plainly. —Alex Sepchenko.

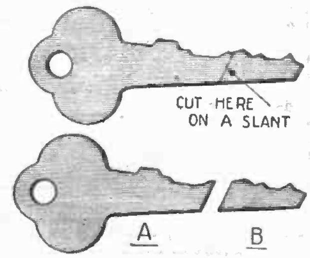
### KNIFE SHARPENER




A knife sharpener can be quickly made from two pieces of thin wood and two discarded razor blades. They are arranged as shown in the drawing. —Samuel Schultz.

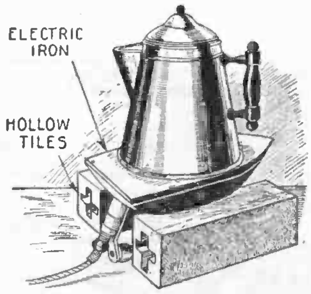
### AUTOMOBILE KEY HINT

If the key to the automobile transmission lock is lost it will not be necessary to buy a new lock, but simply get a new key and cut as shown. Section B is cemented into the lock.—W. C. Gibb.

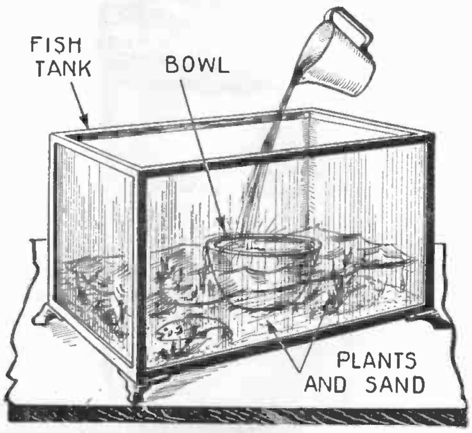



### EMERGENCY STOVE

An electric iron inverted and placed between two hollow tiles makes an excellent electric stove. The tiles hold the iron in place and insulate it from adjoining surfaces.—Samuel Schultz.

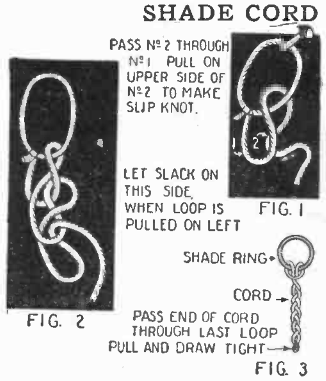



### CHANGING FISH TANK WATER



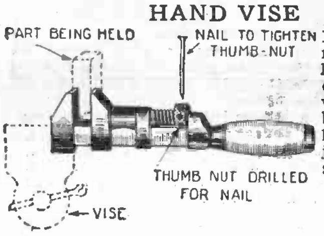

Fish tanks should always have plants growing in them and the water should be changed frequently. The water should be removed with a syphon, and when refilling the tank set a bowl or small pan at the bottom as shown in the illustration. This will prevent the plants from being washed out.—G. N. Alworth.

### SHADE CORD




A serviceable window cord can be easily woven by following the directions given at the left. A piece of string about six feet long is used. These plaited cords will last much longer than ordinary window shade strings.—J. Duncan.

### HAND VISE




If the thumb nut of a monkey wrench is drilled, the wrench may be used to hold small objects, as shown.—D. S. Jenkins.

### TOOL HANDLE

Very useful handles for small tools can be made from auto tube dust caps. The tool to be mounted is held within the center of the dust cap and melted lead is then poured into the opening.—Dr. Wm. G. Walton.

# Readers Forum

**SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them, whether caustic or not. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words or less, and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 230 Fifth Avenue, New York City.**

### WATCH MEDIUMS IN THE DARK

*Editor,* SCIENCE AND INVENTION:

In a recent number of SCIENCE AND INVENTION there appeared a description of the infra-red searchlight which rendered it possible for the operator by means of this apparatus to see in the darkness. As explained in the article, "The apparatus makes use of the infra-red rays, those invisible heat rays which are found beyond the red end of the spectrum. The invisible searchlight has 200 to 300 times the penetrating power of ordinary light through darkness, fog or smoke and consequently will find many uses in our existence."

A rather novel use would be the watching of so-called spiritualistic mediums who operate solely under cover of darkness. In view of the fact that most mediums perform their seemingly supernatural feats and manifestations in a room where light is entirely excluded, it greatly increases and magnifies the importance of this apparatus in exposing these fraudulent mediums. If the principle of this apparatus can be manufactured into a compact portable device it could be readily used with great advantage. No doubt the spiritualist, upon learning the operation of the machine, would suddenly lose his power to execute any spooky performances in dark rooms. Also the device must be so constructed that the hands will be free to move in any direction. In other words, the first part must fit over the head much like a gas mask.

However, the point I wish to bring out is this. With the above described apparatus at your command, I am sure it would be of great interest to your readers to make a tour of the city, exposing fraudulent mediums. I think the infra-red ray device would be of great help to Prof. Dunninger in his spiritualistic investigations—twenty-first century machine to combat and outwit the clever spiritualist.

Tales From The Scientific Club is a fine feature and here's hoping it will be continued.

THOS. ZASCHKA,
Richmond Hill, L. I.

### UNUSUALLY DIRECTIVE THOUGHTS

*Editor,* SCIENCE AND INVENTION:

I would appreciate your opinion or explanation, and also of any readers who have had any similar experiences, or can give a plausible theory as to the cause of the following; the first happened to me, the other two to a person I am well acquainted with:

1. During my grandfather's last illness, my mother and an aunt were at the home of two other aunts where my grandfather lived. I went there from school one noon and opened the side door. As if I were looking on a familiar picture I saw one aunt in the basement doing some washing, another aunt in the background. I knew the conversation to follow, and it seemed as if my very words were chosen as I inquired about my grandfather's condition. I also knew my aunt would reply half crying. "I don't believe he'll live out the day," and she did.

I've had other snatches of scenes or conversation seem like a repetition, but never as complete or clear as that one.

2. A lady had a daughter just learning to use scissors. The girl was on the floor playing with a pair, and her mother looked in the room. She suddenly saw a picture of her daughter at the door, with a hole cut in the curtain. Thinking it merely as something that might happen, she went back to her work. Coming back a little later, she saw her daughter at the door, a hole in the curtain the shape and position precisely as she foresaw it.

3. This same lady was in the garage one night helping her husband with the car, using a lantern. He set the lantern on the ground several feet back of the car, and went around in front. Suddenly she saw a picture of the car backed out over the lantern, but said nothing as she thought it merely a passing thought of hers. Her husband got in the car and backed over the lantern exactly as she saw it.

I've heard people tell of being in a room or house for the first time, and having it seem familiar, or of conversation seeming like a repeated one, but what causes it?

Where the recollection comes after the event, it might be an unconscious remembrance previously, perhaps when a baby, or in the case of conversation, an obvious reply to the situation or question, but in the case quoted first, why did it seem like a repeated experience when it was the first time I had ever known my grandfather to be sick? How did I know what my aunt would reply, when he might have improved or have died? In the second case, granting that a child is likely to crawl over to a curtain and cut it, how did her mother know where she was going to do it, and the shape? Thirdly, the backing over the lantern is not unusual, but why, as in the previous examples did it come as having already happened in exactly the way it finally did happen?

I don't believe in spiritualism, psychic phenomena, mind reading, second sight, fortune telling or anything similar, but I can't account for this by any of these or mental telepathy (which I'm very skeptical of), psychology, or any other theory.

I've heard believers of re-incarnation quote these experiences as proofs of their beliefs, but that is absurd on the face of it, as a number of years would elapse between the different lives, making a reoccurrence of any experience under the same conditions impossible.

These episodes are quite common with most people as books have been written with the plot based on similar happenings, but has any solution ever been found for them?

G. E. VALENTINE,
Grand Rapids, Mich.

**(We wonder if a solution has been found? Yet—there is nothing to prevent two people from thinking of the same thing at the same time;** therefore surely nothing to prevent one from visualizing a scene which may follow a few moments or hours later. The writer has frequently warned his youngster not to tear pages from a book. If this actually occurred, would that be any indication that the event was foreseen?

The curtain was probably in a particularly opportune position, so was the lantern. Had you been in the car you would have driven over the lantern in the same manner. The position of the objects suggested the thought, which would have been fulfilled unless positions changed—EDITOR.)



### AN ASTROLOGER'S VIEWPOINT

Editor, SCIENCE AND INVENTION:

I am prepared to meet doubt in your mind, and I respect honest differences of opinion. The clue to accuracy in astrology lies in more care as to birth data and fuller information as its details. Then in the hands of competent students, astrology has great treasures to give. But as now, in the hands of the ignorant, and those who see in its outer meanings a chance to make a lot of money easily and quickly, even more data would create greater confusion. One of the "astrologers" described generally as a very fine student is not so long in the study. The work done bears this out. It is easy for a student who really knows the subject in its inner values to classify the workers who do not. The time is coming when the uninformed will be so discredited that they cannot go on taking money for such trivial copying as is now their almost uniform custom.

If your challenge can rid the world of such pretenders, you will be doing the public and the serious students a real service.

ELEANOR JENNINGS,
Seattle, Wash.

**(We all respect differences in opinion and the pages of "Science and Invention" Magazine would not be conscientiously open to a discussion of astrology unless we permitted astrologers themselves to argue their side of the story. Most of the letters which we receive from astrologers are entirely too long for publication. A rather long epistle appeared in the last issue of this publication. Nevertheless, we will present both sides of the story whenever possible. We have every desire to be eminently fair and as we lay no claims to infallibility, we will be pleased if our readers point out our errors. We respect the serious students of astrology, because we know that they too are interested in learning the facts of both sides of a controversy.—EDITOR.)**

### JOURNALISM AND SCIENCE

*Editor,* SCIENCE AND INVENTION:

Occasionally a scientific article will appear in the magazine section of the *New York Evening Journal,* and also in the magazine sections of the Sunday papers throughout the country. The one from which I quote appeared in the Saturday, October 15th issue of the paper named above, called "Tracing the Deep Sea Fate of Missing Planes and Flyers."

I have read in your publication that a sinking ship will always come to rest on the bottom of the ocean, and so cannot account for the underlined statements made in this article, which I enclose.

CHARLES P. WARNER,
New York City.

**(The article to which the writer of the above letter referred, says in part:)**

"The experts say the cabins of the wrecked planes were probably pulled downward by the heavy motors at the front, much like a ship diving toward the bottom. Little is known about what happened to them after they plunged into the darkness of the under sea mysteries a mile or more beneath the surface. They may be hanging suspended there, prevented from going deeper by the tremendous water pressure. . . ."

**(Any body that sinks beneath the surface of the sea will continue to sink until it rests on the very sands or the rocky bed of the ocean or else it will again come up to the surface and float. A state of stable equilibrium is not possible at any time, regardless of the extent of the water pressure. If the water pressure were acting purely in an upward direction, it is conceivable that the water might be able to buoy up the ship; but water does not act in that way, except in the minds of some novelists. The pressure of water is equal in all directions and there is very little difference in pressure of that part of the water pressing down on top of the hull and that portion which is immediately beneath the vessel, tending to force it up, whereas still other water is attempting to crush in the sides.**

**An interesting illustration is given by the ordinary Cartesian diver, which may consist of an inverted pill bottle barely afloat in a jar of water. Across the top of the jar one stretches a rubber diaphragm. When this rubber diaphragm is pressed downward, the small floating bottle at once sinks to the bottom, and when pressure is released, it returns to the surface. We thus have in front of us a miniature ocean and a miniature ship afloat in that ocean. By regulating the pressure, we can produce a semblance of a ship sinking in water. If we erect a micrometer screw and press down upon the diaphragm by means of this micrometric adjustment, we can produce any desired pressure, yet, regardless of how carefully we operate the mechanism, at no time can we cause this miniature ship as it were, to remain suspended halfway between the surface and the bottom. Either the ship sinks clear to the bottom or else it comes up to the surface again.**

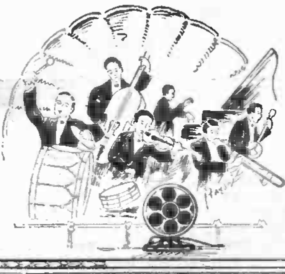
**While it is true that we can cause this action to proceed rather slowly, the fact remains that a stable state of equilibrium cannot be obtained. The same is true in a submarine. A submarine cannot be made to float beneath the surface of the water at any predetermined depth, unless it is either moving forward or the air tanks are being manipulated by an operator.—EDITOR.) The article continues:**

". . . they may have gone farther and been crushed into a powder . . ."

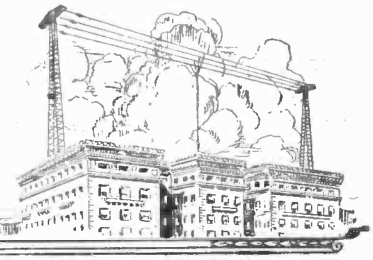
**(Another impossible condition. As stated before, the water pressure is equal in all directions, and while it is true that air-tight bodies may be stove in by the terrific pressure, they cannot be ground into powder. The pressure at the bottom of the ocean's greatest depth is only 7¼ tons per square inch. This figure is not so phenomenal as to cause us to wonder about its supposed potency. —EDITOR.) Continuing:**

". . . they may lie in the slimy ooze of the sea floor, surrounded by queer, pulpy, phosphorescent sea creatures, or parts may be at the bottom while

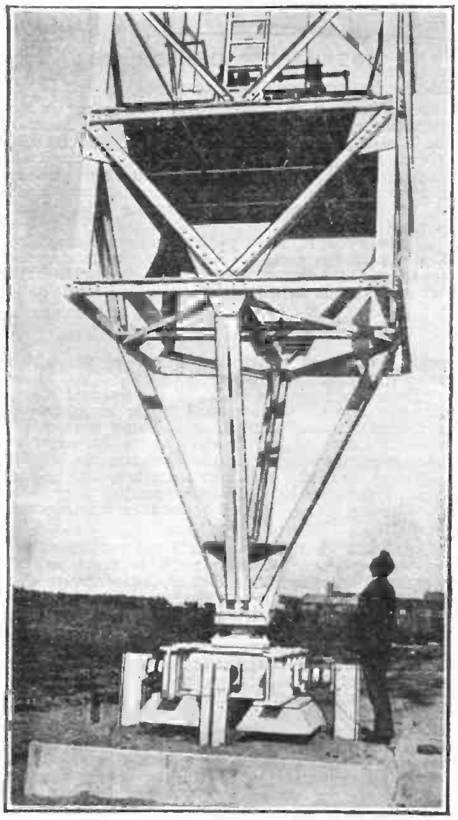
(*Continued on page* 859)



# RADIO

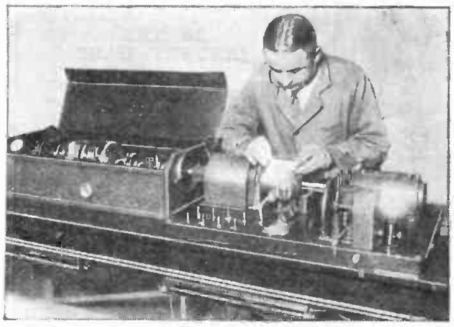


# Germany's Giant Radio Station



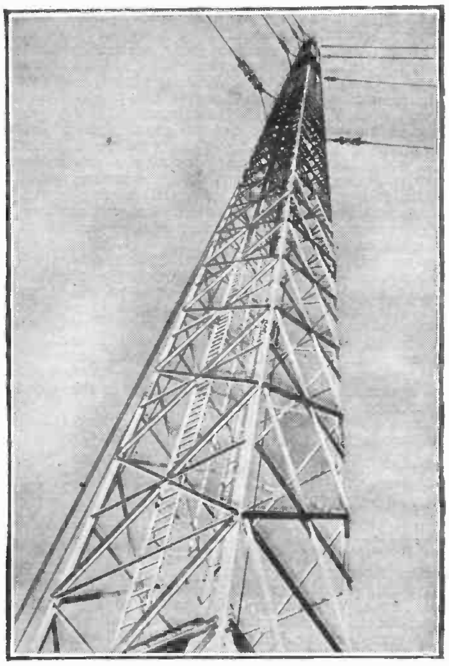
Above we have a photograph showing the base of one of the huge aerial supports. Note the novel method of construction which allows the entire aerial system to sway with the wind.

One of the largest antenna systems has recently been erected near Berlin, Germany. Two views of the mammoth towers used to support the wires are shown here. Each of the towers is 689 feet high and support an aerial 1476 feet long between them. These are used in conjunction with the new 40 kw.



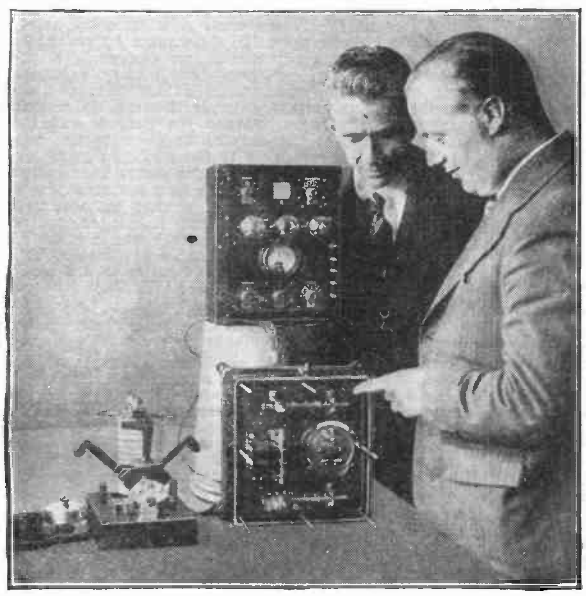
A device used for transmitting pictures over the air has been installed in the new station and is shown above. This machine is one of latest design and will transmit pictures in thirty seconds.

station which has recently opened in Berlin, operating on a wave length of 1,250 meters. The ball at the base, upon which the tower is pivoted allows it to swing freely. A new system for transmitting pictures via the ether has also been installed, a view of the apparatus being shown on this page. This device will transmit a telephoto or a photograph in 30 seconds.



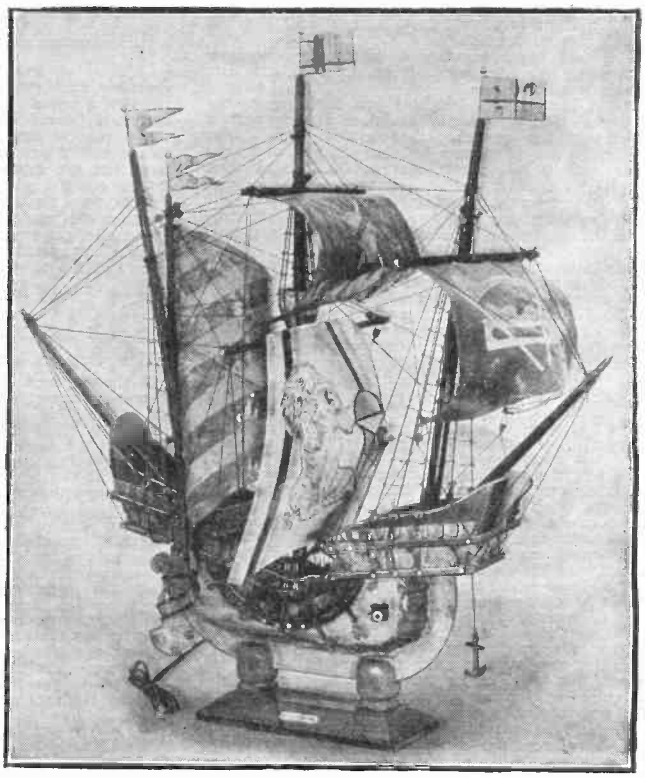
Another view of the antenna mast, showing its top portion, may be seen above. Note the ladder which is used in making repairs.

## Marconi Automatic Alarm



At the left is shown the Marconi automatic alarm for S.O.S. signals. The device consists of a 3 - tube receiver working in conjunction with a selector. Both units are operated automatically, and intercept distress calls, when operator is off duty.

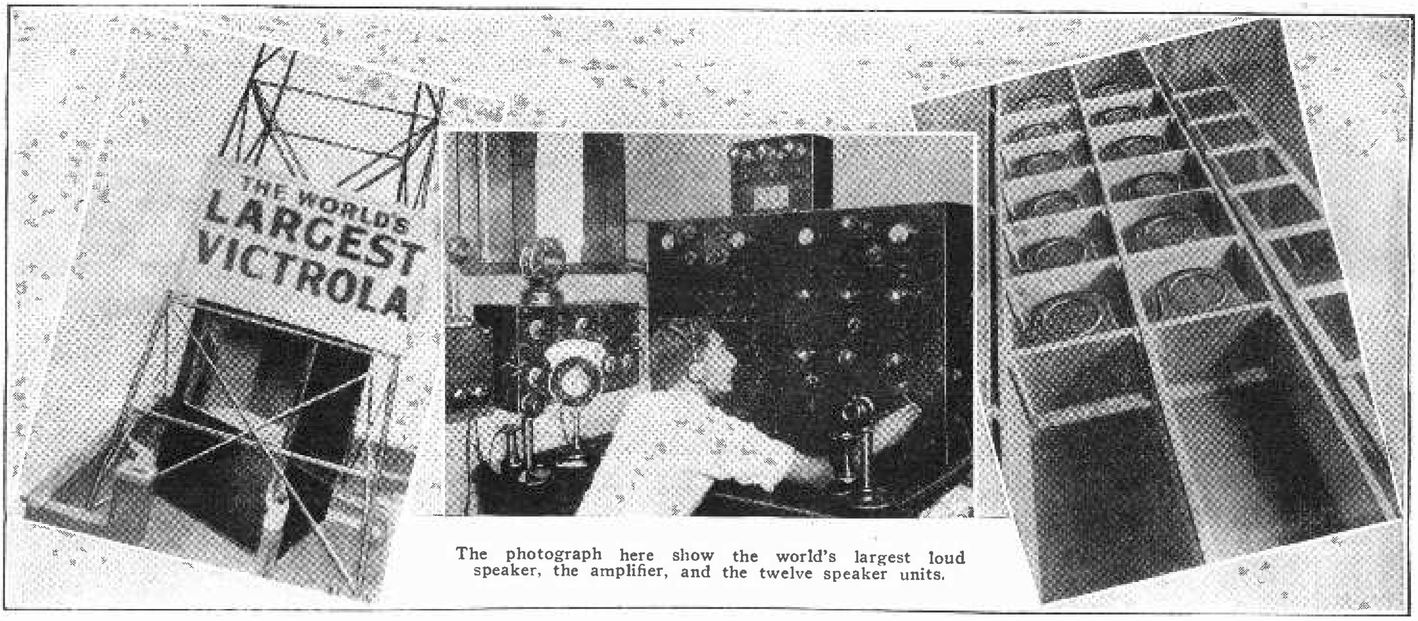
## Ship Model Speaker



At the right is a photo of a recent radio loudspeaker which is becoming popular with set owners. The sail in the middle is made of heavy cone paper and the unit is attached to the mast.

*Illustration courtesy Miniature Ship Models, Inc.*

# WORLD'S LARGEST LOUD SPEAKER

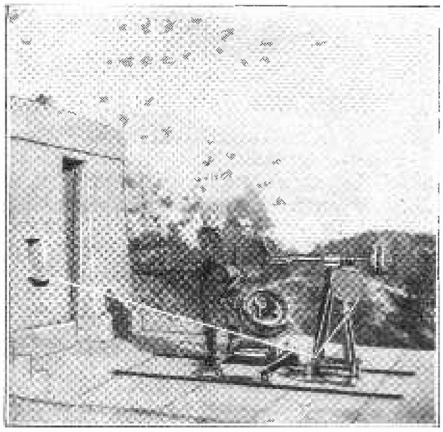



The photograph here show the world's largest loud speaker, the amplifier, and the twelve speaker units.

THE largest loud speaker in the world was recently constructed on top of the building in Paterson, N. J., which is occupied by radio station WODA. This gigantic speaker is a combination of both the horn and cone types, weighs over one ton and derives its "voice" from twelve loud speaker units which receive their power from a 500 watt amplifier. The speaker stands ten feet high and is eight feet wide. It is used to reproduce the WODA studio programs so that a goodly section of Paterson can hear them. The photograph at the right shows an interior view of the loud speaker with the twelve units. The center photograph shows the 500 watt amplifier installed in the station and the photo at the left shows an exterior view of the great loud speaker. Its size can be appreciated by comparing it with the men appearing in the photo. This huge speaker has attracted much attention, and when first tried out could be heard more than one-half mile away from the station. Whenever it is in operation it never fails to attract large crowds of people, especially during the broadcast of the World's Series baseball games.

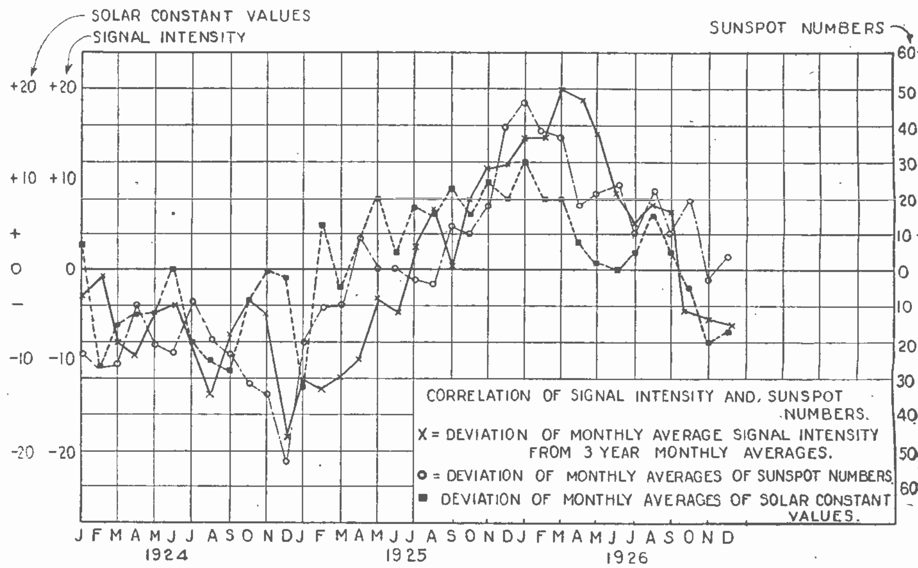
# Radio Reception Dependent on Solar Radiation

*By* UTHAI VINCENT WILCOX



Above is a photograph showing a portion of the observatory and the instruments which were used at Table Mt., Calif., for the determination of the relation between long range radio reception and solar radiation.

IT seems to have been proved that the strength of reception of long distance radio appears to be almost wholly a function of the variation in the sun's radiation. This radio discovery was made by Dr. L. W. Austin, of the United States Bureau of Standards, who has just completed a three year study of radio reception and compared his resulting curves with the curves made by the Smithsonian Institute which has made a special study of solar radiation over a period of time covering that of Dr. Austin's studies. Both working independently of each other have found that their curves corresponded almost exactly. Dr. C. G. Abbot of the Smithsonian Institute considers this one of the most vital investigations of the day, and abundantly justifies the twenty-two years already spent on solar investigations by the institute. Some years ago Dr. Abbot presented proofs that the variations in the short or ultra-violet wave band of the sun was much greater than in the long or infra-red wave band. This is now confirmed by the observations of Pettit at Mt. Wilson Observatory, who finds that variations in the ultra-violet spectrum show an intensity as high as 60 per cent greater than variations in the green spectrum. This fact may also help to explain the greatness of the influence on the earth's weather of a very small change in total solar radiation. Dr. Abbot presents indisputable proof that the sun's radiation varies and has an effect on long range radio reception as determined by Dr. Austin.

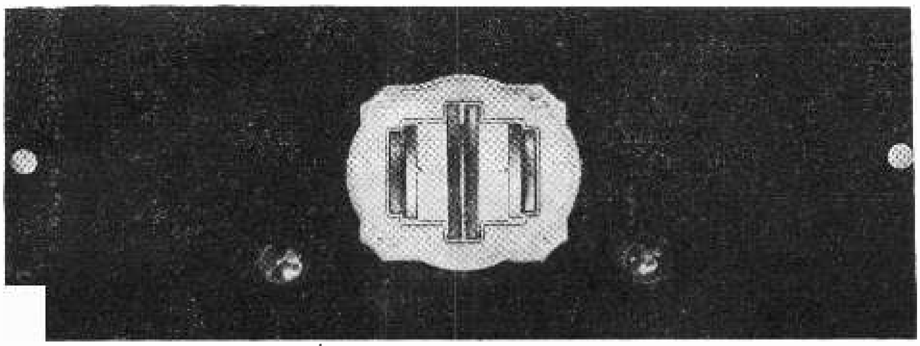



The above graph shows the correlation of signal intensity, solar constant values and sun spots. This discovery was made by Dr. L. W. Austin, of the U. S. Bureau of Standards.

# THE HAYDEN

## In Which the Author Details the Construction of an Efficient

By HERBERT



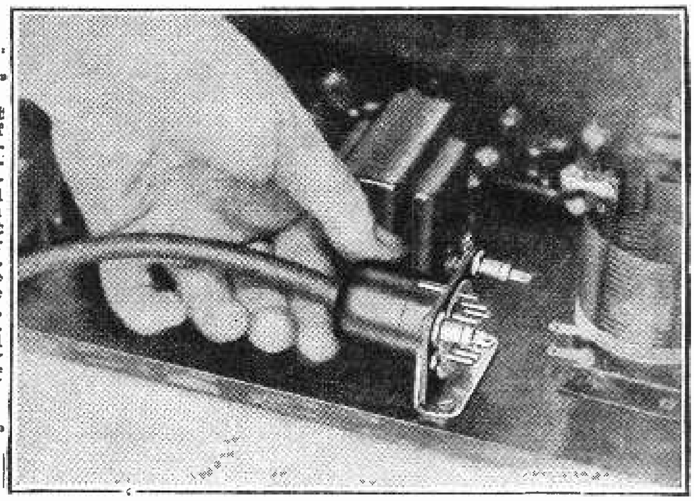
A front view of the receiver, showing the exceptionally neat panel arrangement, is shown in the above photograph. Note the placement of the drum controls.

THE receiver described here affords an exceptionally pleasing appearance and constitutes a type that is becoming more and more popular with the radio fan. Years ago it was practically impossible to construct a super-heterodyne which would work efficiently because the intermediate frequency transformers were not matched and varied a great deal. The set described here uses two iron core intermediate frequency transformers and thus the cutting off of side bands which occurs in some receivers has been eliminated. An air core filter placed immediately after these greatly sharpens the tuning and gives added selectivity which would otherwise be impossible if only iron core transformers were used.

### CONSTRUCTING THE RECEIVER

The layout of parts may be readily seen in the photograph appearing on this page. The placement of apparatus is important. Notice the wide space between the intermediate frequency coils and the oscillator coil. The oscillator and antenna coupler are mounted on the left-hand side of the baseboard with the intermediate frequency coils and fixed condenser at the rear and the five sockets just in front of these. The cable connector plug is mounted at the rear of the baseboard as shown in the photo. No audio frequency stages are mounted on the baseboard, as they are included in the form of a power amplifier installed in the bottom compartment of the console. The drum control, rheostat and small midget condenser are mounted upon the front panel, thus obtaining a beautifully balanced and symmetrical layout. The receiver is probably most easily wired with flexible hook-up wire, and there is also less chance of a short-circuit occurring.

The photo at the right shows a novel method of mounting the cable connector plug, which was devised by the author. Trouble is often experienced if the plug is mounted in the regular position, as it often becomes loosened or is pulled out altogether. This source of annoyance is eliminated when the plug is mounted sideways, as shown in the photo. When the set is moved about, the plug will stay in its correct position if this hint is followed.



### OPERATION

A center tapped loop is used with the receiver and the regeneration is controlled by the small midget condenser which is placed in the plate circuit of the first detector tube.

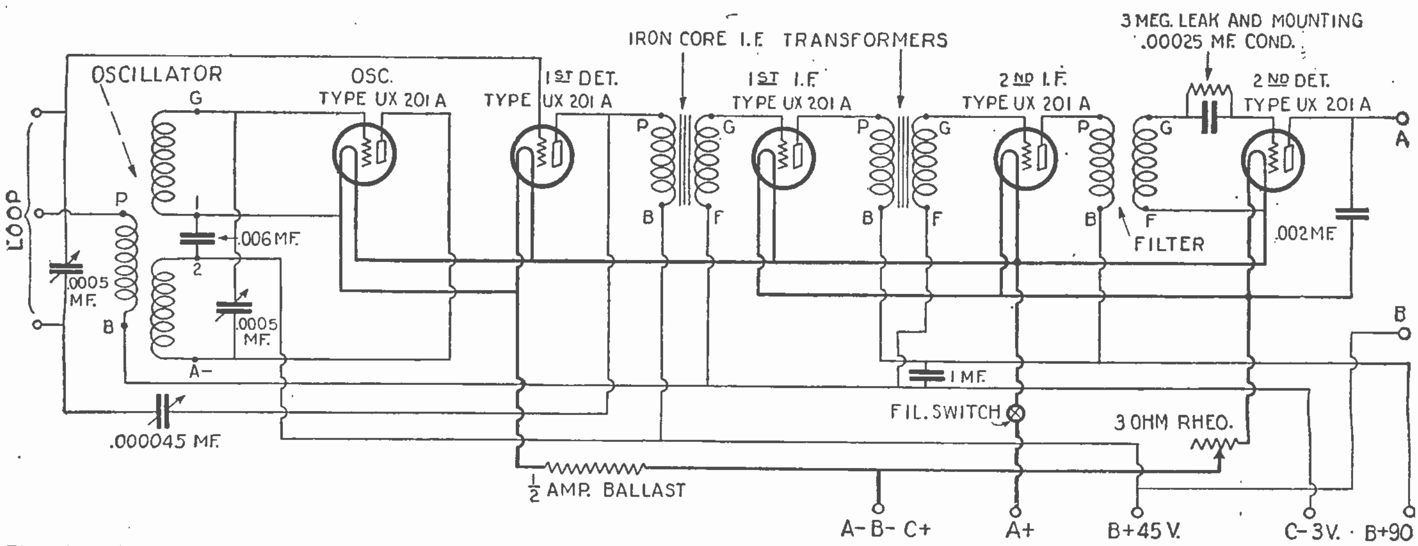
By installing an antenna coupler in the receiver it will be possible to use an outside antenna and a ground. The set will be found to give sharp tuning without sacrificing quality and when used in conjunction with the power amplifier will give a surprising depth of tone, clarity and beautiful musical shading.

### TUNING THE RECEIVER

The receiver is really easily tuned when once its operating characteristics are thoroughly understood and patient tuning is observed. For local reception, lower filament temperature is used on the intermediate frequency stages than for distant stations.

### HINTS ON WIRING

It will probably be easiest to wire the complete filament circuit first. Next, the tuning circuits, consisting of the tuning condenser, first detector and oscillator circuits Then the intermediate radio frequency stages are wired and finally the second detector. The circuit, as shown in the diagram, provides only for the use of the receiver with a loop, but an antenna and ground may be used by connecting an antenna coupler to the loop terminals.




The schematic diagram of the receiver described here is shown above. Two iron core intermediate frequency transformers and a filter are used. A three-ohm rheostat controls the last three tubes.

The "C" bias method of detection is used on the first detector, three volts being applied to the grid of this tube through the center tap of the loop. A one-half ampere ballast controls the first two tubes.

# DE LUXE SUPER

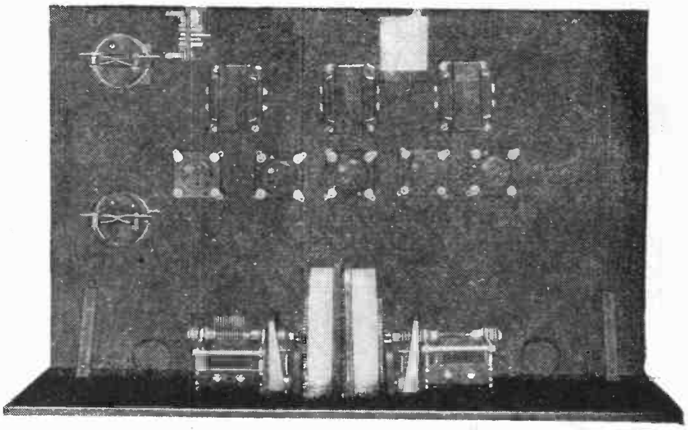
## Receiver Used with a Power Pack To Be Described Next Month

### HAYDEN

#### BATTERIES USED

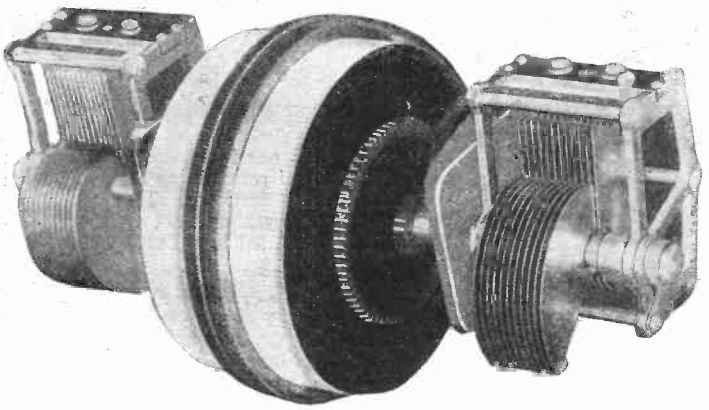
A filament switch is connected in series with the A+ lead and turns off the filaments of all five tubes. A three-ohm rheostat placed in series with the A— lead controls the two I. F. stages and the second detector. A one-half ampere ballast also placed in series with this lead, controls the filament voltage delivered to the oscillator and first detector tubes. Forty-five volts are used on the plates of the oscillator, first detector and second detector. Ninety volts are used on the two intermediate frequency stages. A "C" bias of three volts is impressed upon the grids of the first detector, and the two intermediate frequency tubes. The A—, B— and C+ are all connected together. The necessary "B" battery voltages are obtained from the power pack, which uses two half wave rectifier tubes. It is recommended that specifications be followed exactly if best results are to be expected.

**The photo at the right shows the neat baseboard layout and the efficient placement of parts. The set as described here uses only five tubes and was designed to operate in conjunction with the power pack which will be described in the next issue. The five sockets are mounted in a row directly in back of the drum control which tunes the variable condensers. A 1 mf. condenser is mounted at the rear of the baseboard.**



#### INSTALLING THE RECEIVER

After the receiver has been completed, it should be installed in a console in order to set it off to its best advantage. The power amplifier unit may then be placed in the bottom compartment with any other necessary accessories. It may be well to test the filament wiring before actually operating the set. To do this, connect the "A" battery across the "B" battery terminals, and if the tubes light, it is an indication of faulty wiring. Before installing the set permanently, it may also be well to test the continuity of all coils with a "C" battery and a pair of phones. The condensers, both variable and fixed, should be tested likewise.



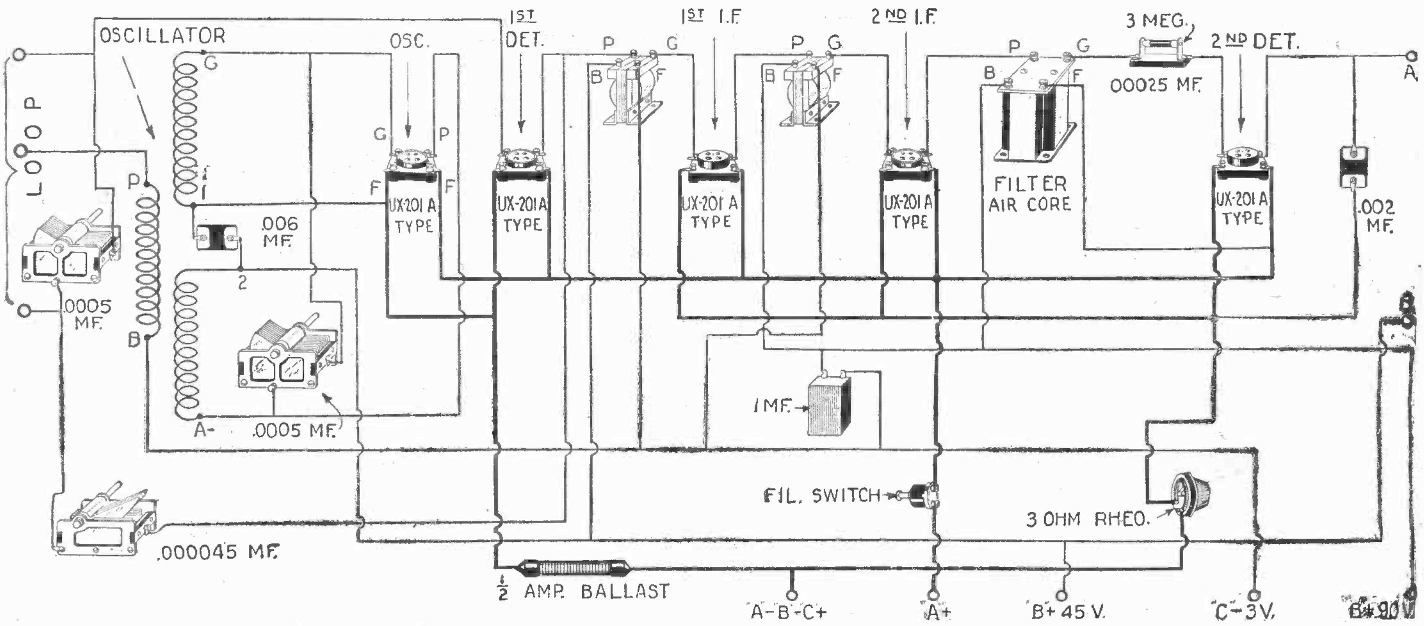
**The photo at the left shows a close-up view of the drum control unit. Note the gear action used in this improved type of drum dial which prevents any back lash or slipping and is positive in its action. A dial of this nature greatly adds to the appearance of the front panel, inasmuch as the control of the receiver is placed in the center and not spread out.**

#### LIST OF PARTS

2 .0005 mf. variable condensers.
1 drum dial.
2 iron core I. F. transformers.
1 air core filter.
1 midget condenser, .000045 mf. capacity.
5 cushion sockets.
1 battery cord and plug.
1 3-ohm rheostat.
1 2-ampere ballast.
1 oscillator coupler.
1 antenna coupler.
1 .002 mf. fixed condenser.
1 .006 mf. fixed condenser.
1 .00025 mf. condenser with grid leak clips.
1 1-mf. by-pass condenser.
1 3-megohm grid leak.
1 filament switch.
1 Louis IV console.
Necessary hook-up wire, solder, lugs, etc.

*Names of manufacturers of parts furnished free upon request.*

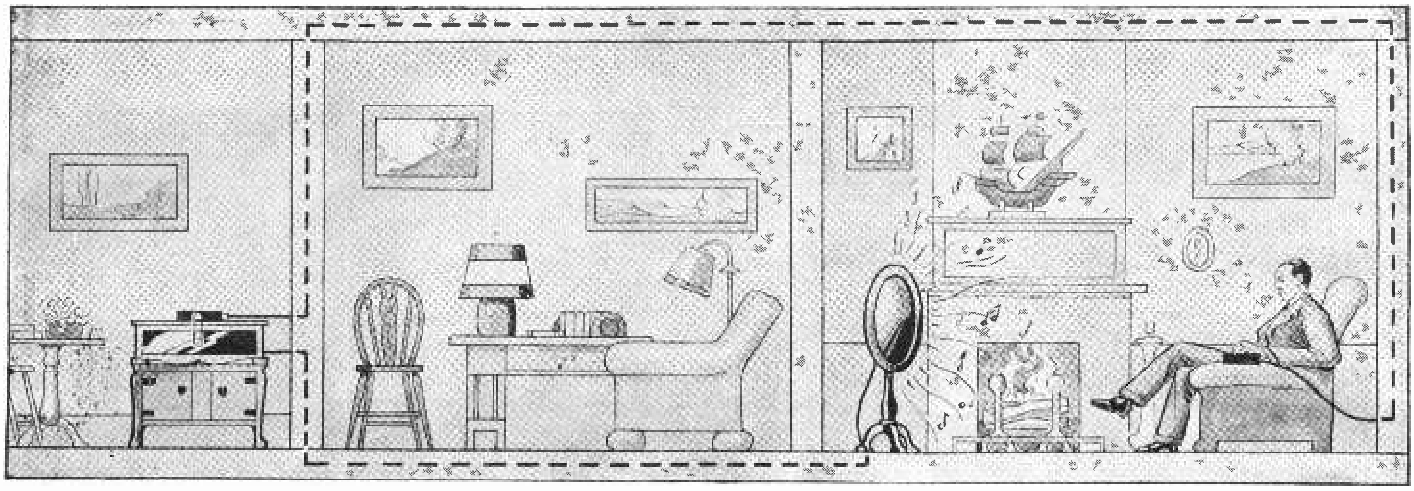
(*Continued on page* 842)




**The picture diagram showing the hook-up of the receiver appears above. The two main tuning condensers are controlled with the drum dial, the only other controls being the three-ohm rheostat and the small midget condenser.**

**Forty-five volts of "B" battery are used on the oscillator, first detector and second detector. Ninety volts are used on the intermediate frequency stages. A 1 mf. by-pass condenser is placed across the C— and B + 90 leads.**

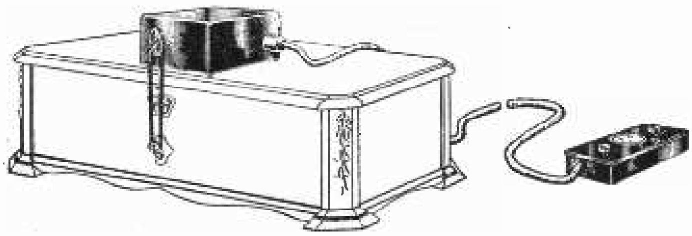
# Remote Control Radio Tuning Device



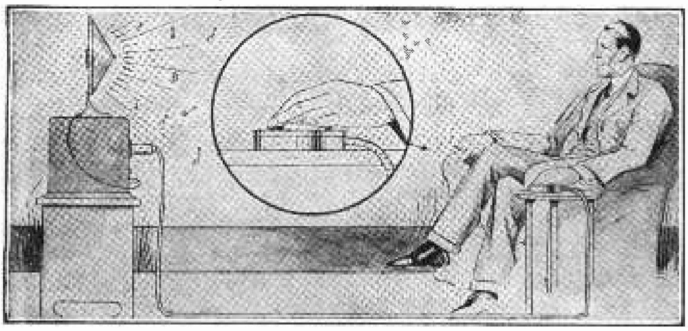
The above illustration shows clearly the usefulness of the new remote control tuning unit, which can be installed on any receiving set.

With this new tuning unit the set can be controlled from any part of the house and the speaker can be placed in any room desired.

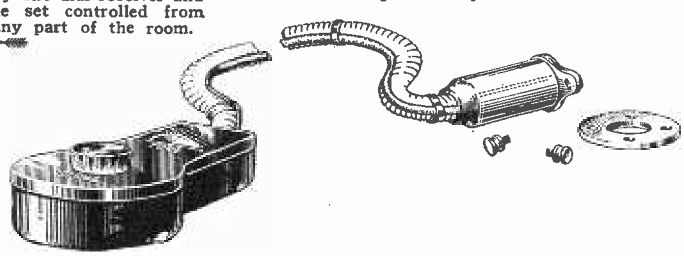
THE control of radio reception at a distance from the set is at last an accomplished fact. A new remote control tuning unit has recently been put on the market which can be obtained in two styles; one electrically driven and the other manually operated. The units are readily attached to any single dial receiver which has a removable dial. The tuning and volume control are regulated from a small box which can be conveniently placed on the arm of a chair. The electrically driven unit can be placed in any room of the house, and removed as far away from the receiver as is desirable. The mechanical unit is operated by a six foot rotating flexible cable manipulated by a button.



At the right is a view of the electrically driven tuning unit and control box installed on a one dial receiver.



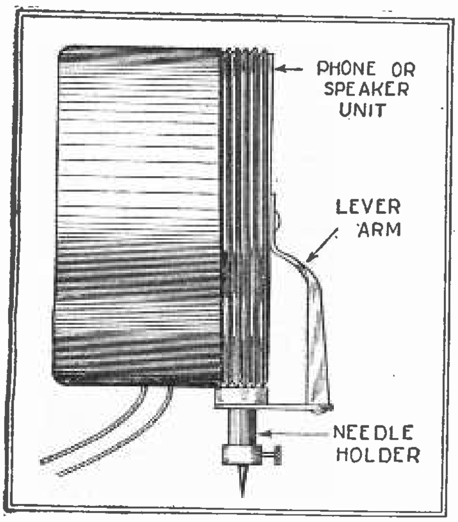
At the left is an illustration showing the mechanical remote control unit. This unit can readily be attached to any one dial receiver and the set controlled from any part of the room.



At the right is shown the mechanical control unit, which is operated manually by a six foot rotating flexible cable.—*Illustrations Courtesy Algonquin Elec. Co., Inc.*

# Making a Phonograph Pick-Up

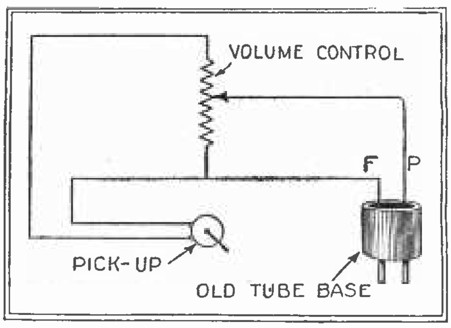
**By WALTER E. BURTON**




The details of the phonograph pick-up device are given in the above drawing. A phone or speaker unit may be used.

PHONOGRAPH records may be reproduced through the audio frequency system of any radio receiving set, by means of an inexpensive pick-up device which can be easily made from a loud speaker unit or high resistance phone and a portion of a phonograph reproducer. The vibrating lever consisting of a needle holder and a projecting arm should be obtained from the phonograph reproducer. The lever arm is attached to the center of the unit diaphragm, providing the diaphragm is made of sheet iron. The needle holder is then mounted on the edge of the receiver or loud speaker unit as indicated in the photograph. The terminals of the receiver are connected across the primary of the first audio frequency transformer in the radio set. If a different system of amplification is used, connections may have to be altered accordingly. Usually one terminal should go to the plate of the detector tube socket and the other to the negative A battery terminal. An old tube base can be used for connecting the pick-up device to the detector tube socket. A variable resistance or potentiometer can be used

(*Continued on page* 860)




In order to attach the pick-up device to the radio set, an old tube base may be used as shown above. A variable resistance is used as the volume control and the old tube base should be plugged into the detector socket, with the radio frequency tubes turned off.

# RADIO ORACLE

**In this department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.**

## GRID BIAS FOR DETECTOR

(599) M. Tesak, Youngstown, Ohio, asks:

Q. 1. Will you kindly furnish me with some information concerning the grid bias method of detection which I intend to use with 199 and 201-A type tubes.

A. 1. The following biases are recommended for use with the tubes mentioned.

| Tube | 45 Volts | 90 Volts |
|---|---|---|
| Type UX199 | —4 to 6 | —17 to 20 |
| Type UX201-A | —4.5 | — 9 to 10 |

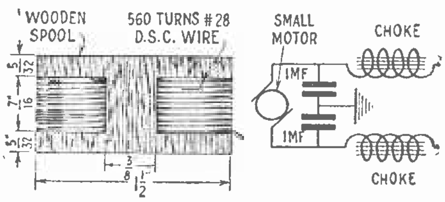
As the value of negative grid bias is increased, the output impedance of the detector tube increases. Several effects may frequently be noticed as a result of this condition. The first is a fall-off in quality of reproduction. It is therefore advisable to use the lowest value of grid potential which may be found satisfactory in actual operation for a given tube and receiver. The next condition is that as the negative grid potential is increased, the tube impedance increases so rapidly that the load of the tube on the transformer primary or coupling device decreases to a point where the audio amplifier may go off into continuous oscillation at a rather low frequency. (This is indicated by a steady hum, or howl, present when a signal is not being received.) The remedy for this condition is a decrease in the value of detector "C" bias or the connection of a leak resistance across the secondary of the first audio transformer, thus loading the secondary of the transformer; and due to the coupling effect, the primary as well. In all cases the output circuit of the detector, before it reaches the audio amplifier, should always be by-passed from plate to filament with a .002 mf. by-pass condenser to keep the radio frequency component of the detector plate circuit out of the audio amplifier. It may frequently be necessary to insert a choke coil in the output plate circuit of the detector tube. This choke should have an inductance of 2½ millihenries and will further aid in the isolation of the audio frequency amplifier from the radio frequency circuits of the receiver and will promote stability. In all cases, every endeavor should be made to keep the detector wiring as short and direct as possible and to condense the circuit arrangement just as far as is practical. The leads to the by-pass condensers, etc., should be very short and direct, and every ordinary precaution taken to see that trouble may not arise in the detector circuit either individually or as the result of the cumulative effect of associated circuits.

## INTERFERENCE ELIMINATOR

(600) G. P. Graham, Ottawa, Canada, writes:

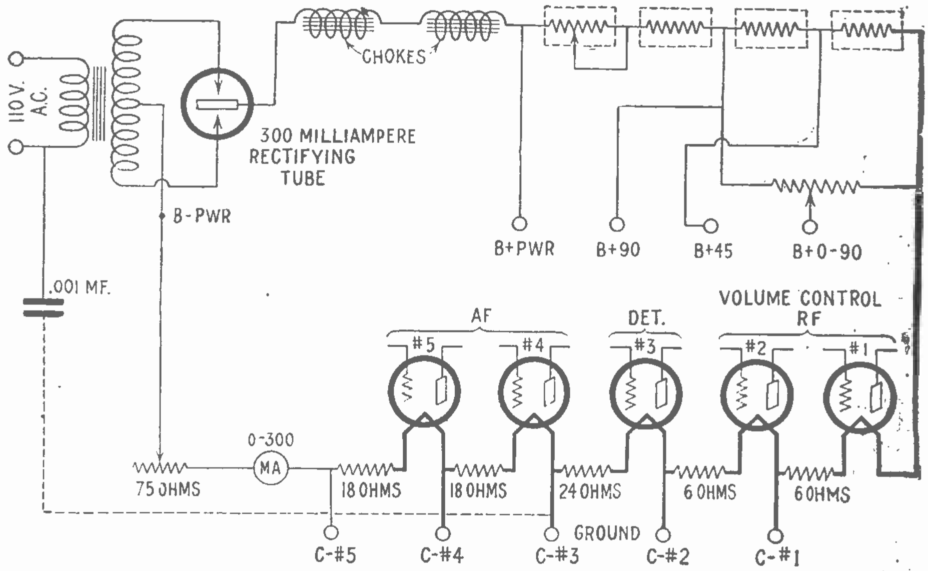
Q. 1. I am troubled by interference in my radio set which I believe arises from the small electric motor in the vacuum cleaner and other portable appliances found in the home. Will you please illustrate in your columns an efficient system for eliminating this interference and give data concerning the construction of the choke coil, if such is used in the filter circuit.

A. 1. You will find illustrated on this page an efficient motor filter which will eliminate interference successfully. The constructional details of the choke coil advocated by the National Electric Light Assoc. are also shown. Two high test condensers of about 1 mf. capacity each are connected in series across the A. C. line, with the mid-point grounded. Two choke coils are then connected in series with each of the A. C. leads as shown in the diagram. This filter arrangement will confine the radio frequency currents to the point of their origin. As in all cases where filters are used, the condensers should be placed as near as possible to the point where the




**Constructional details of the choke coil and hook-up of the interference eliminator.**

noise originates. This precaution will prevent the broadcasting of interference with condenser leads acting as the antenna. The choke coil is wound on a wooden spool, finished with shellac, and consists of about 560 turns of No. 28 D. S. C. wire. Suggested dimensions for this coil are given in the illustration. The brushes on the motors should be thoroughly cleaned, as dirt and corrosion cause the contact to become erratic, causing much sparking, and therefore interference will result. If the iron shell of the motor is grounded, this will help to eliminate the interference. However, old motor installations were frequently made on wooden supports and were thus insulated from the ground. Condensers specially made for filter purposes are now available in the radio market, as are condenser choke combinations mounted and ready to connect. It should be borne in mind when installing any of these devices that large capacity condensers contain wax, and therefore should be placed where heat generated by the motor will not affect them.




**Connections for series filaments with a 300 milliampere rectifying tube are shown above.**

## SERIES FILAMENT CONNECTIONS

(601) M. McCarthy, El Paso, Texas, writes:

Q. 1. Will you kindly show me how to connect the filaments of my 5-tube set in series, so that I may obtain "C" bias for all tubes. At present I am using 201-A type tubes. The enclosed diagram shows the hook-up of my present "B" eliminator, which uses a 300 milliampere rectifying tube.

A. 1. We are reproducing upon this page the circuit diagram of the "B" eliminator, showing the series filament connections and the proper resistances to be used for obtaining "C" bias. The values of resistance as given are suitable when using type 201-A tubes with the new 300 milliampere gaseous rectifying tubes. The panel rheostat should be rated at 75 ohms and compensates for any changes in line voltage. If a higher resistance is used, the tubes may be damaged and the rheostat itself will overheat. In order to obtain a bias for the last tube in the circuit, it will be necessary to insert an additional resistor as shown at the "C" terminal for the fifth tube. This gives a bias of 4.5 volts to the grid of the last audio tube. Series resistors from 4 ohms to 18 ohms will give a bias voltage from 1 volt to 4½ volts. This method of obtaining bias voltages is very satisfactory for the more rugged 201-A type tubes where the filament current is large compared to the plate current. Any value of biasing voltage may be obtained according to the following table:

| Grid Bias | Resistance |
|---|---|
| 1.5 volts | 6 ohms |
| 2 " | 8 " |
| 3 " | 12 " |
| 4.5 " | 18 " |
| 6 " | 24 " |
| 9 " | 36 " |

## NEUTRALIZING 6-VOLT TUBES

(602) Q. B. Malvern, Fresno, Calif., writes:

Q. 1. I have a 5-tube receiver with two stages of radio frequency employing the split secondary type of neutralization. Using 1½-volt tubes, I was able to get the set neutralized fairly well, but I have recently changed over to 6-volt tubes having similar characteristics and am experiencing trouble in neutralizing the set. Will you kindly give me a remedy for this difficulty?

A. 1. It seems logical that the 6-volt tubes do not require so much capacity to neutralize them as did the former type you were using, and the neutralizing condensers if not of an extremely low minimum capacity, will prevent neutralization from being obtained. If you find therefore, that the more you increase the capacity of the neutralizing condensers, the more unstable the set becomes, then the trouble is undoubtedly due to the cause mentioned. To remedy this, it is necessary to increase the plate-grid capacity of the tube, in order to bring it between the maximum and minimum values of the neutralizing condensers. The adjustment of these condensers will then allow perfect neutralization. The additional capacity between the plate and grid of the tube can be obtained either by connecting small neutralizing condensers between the plate and grid and keeping the condenser at almost minimum capacity, or else, by connecting two pieces of insulated wire about 4 inches long, to the plate and grid terminals of each tube socket and twisting the pieces together, thus forming a small condenser.

## SHORT-WAVE CONDENSER

(603) T. S. Broch, Minneapolis, Minn., asks:

Q. 1. I am planning the construction of a receiver to cover the short-wave bands between 30 and 200 meters, but I do not seem to be able to find any really authentic information as to the proper size for the tuning condensers to be used in such a circuit. The circuit that I have selected is the shunt-feed Hartley circuit, and I am planning to use plug-in coils that I expect to make myself. I realize that if I use a very small tuning capacity I shall have to make quite a number of coils to cover this wave band; but I am willing to do this. What I want is an arrangement which will enable me to spread the stations well out over the dial instead of having them all crowded in together, as they are on most short-wave receivers that I have heard in operation.

A. 1. In the shunt-feed Hartley circuit there is only one tuning condenser; the other condenser is used to control regeneration and may be a standard 250 micro-microfarad (.00025 mfd.) receiving condenser. It is immaterial whether this latter condenser is straight-line-capacity, straight-line-wavelength or straight-line-frequency; the selection of the tuning condenser, however, is most important. The tuning condenser should have a tuning capacity of approximately 40 micro-microfarads (.00004 mfd.). Using this condenser, seven coils in all are required to cover the waveband you mention. The wave length range of each coil slightly overlaps the wave length range of the next smaller and the next larger coils so that the band from 27.7 meters to 225 meters is completely covered. Even with such a low-capacity tuning condenser as this, there is some crowding at the lowest wave lengths; but if a high ratio vernier dial is used with this condenser, there is no overcrowding and the tuning becomes quite simple. The tuning condenser should have an approximately straight-line-frequency characteristic.

Tuning on the short waves will be found to be considerably sharper than on the intermediate or high wave lengths. It will also be noticed that atmospheric disturbance is greatly reduced and that volume is invariably increased. In order to eliminate antenna harmonics, it may be necessary to place a small fixed condenser in series with the aerial.

# Scientific Humor

### TAKE YOUR CHOICE

DOCTOR: "My dear young lady, you are drinking unfiltered water, which swarms with animal organisms. You should have it boiled; that will kill them."

PATIENT: "Good gracious, doctor, I think I'd sooner be an aquarium than a cemetery."—*Miss Nellie Taylor, Rep. No. 22,048.*

### HARD BOILED

CUSTOMER: "This must be an incubated chicken."

WAITER: "What makes you think so?"

CUSTOMER: "No mother would have a daughter as tough as that."—*Leslie Carpenter.*

### BURNS AND BOILS US UP

A quack doctor was sent for once, to treat a man who was suffering from a very bad boil on the back of his neck. He took a look at the boil, assumed a wise expression, and said:

"Have you got a poker?"

When he was told "yes," he gave directions that the end of the poker be put into the fire to become white hot. Then he applied the hot end to the boil. Naturally the victim yelled.

"There," said the quack, "I guess that will do the trick. I'm not much good on boils but I'm great at curing burns!"

—*Adolph F. Lonk.*

### BELIEVED IN SIGNS


There had been a collision of automobiles just where a side street crosses the highway.

"Look here!" stormed the traffic policeman to the driver of the car responsible for the accident. "What's the big idea? You were coming down the side street; didn't you see that sign on the corner—THROUGH TRAFFIC?"

"Why, yes," responded the other meekly, "and that's just what I did—drove through!"

—*Margaret Ullmann.*

### IS NOT KNOT A KNOT?

"What are those holes in the floor?"

"Those are knot holes."

"They are too."—*Emerson Gaze, Rep. No. 12414.*

## First Prize $3.00

### COMPLEX STRATUMITIS

The old gentleman firmly established himself upon his idea of an ideal location and began to drill. His driller's log is as follows:

1. Loose, powdery sand. Easy drilling.
2. Thick layer of peculiar red iron oxide formation. Hard on drill. Slow progress.
3. Several layers of strange, sticky creamy and gummy muds and clays.
4. Have gone as deep as drill is capable of going.

He gave up in disgust.

"Hang my liver!" said he. "If gals don't quit usin' cosmetics, we 'skeeters' are all gonna starve!"—*Ed. Blume.*

### MODERN YOUTH

FATHER: "Come, here, son, I'm going to dust your pants with this shingle."

TOMMY: "Aw, why dontcha be up-to-date and use the vacuum cleaner?"

—*Henry A. Courtney.*

*WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.*

*All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.*

### INTERIOR DECORATION

It was a scientific picture of the educational type, showing X-ray views of the various organs in the human body.

"Glory, Sam," exclaimed a negro in the audience, "Ain't dat wondehful?"

"Niggah," replied his companion, in a vastly superior tone, "dat's jist what dey call one ob dese here interior scenes."—*Henry Vanderholt.*

### SHOULD HAVE SPOKE-N UP

A dull farm hand, on being told to grease the wagon, came in about four hours later with, "I have greased the wagon all over but them sticks the wheels hang on."—*Miss Ida M. Guthrie.*

### SOME GAS

(From a schoolboy's letter)

"Please send me your new device for Ford cars as advertised in the———Magazine that runs forty miles on a gallon of gas."—*Miss Delma C. Conway.*

### SPIRITUAL COMMUNICATION

1ST STUDENT: "Do you know that a solid conducts sound better than the air? For instance, the Indians used to put their ears to the ground in order to hear sounds a great way off."

2ND STUDENT: "Sure—and if you put your ear to a third rail, you'll hear the angels singing."—*Harry P. Lynch.*

### WHEN TIME FAILED


BIM: "Have you timed your car yet?"

BAM: "Yes. It stood perfectly still for two hours and six minutes right in the middle of the road last Sunday afternoon!"

—*Henry A. Courtney.*

### IT'S BOTH

SMOKY: "Tell me a three-letter word for radio fan?"

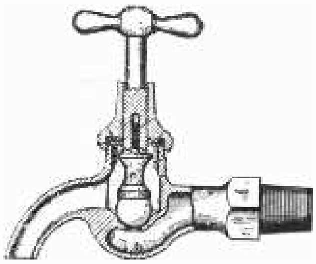
BILL (sarcastically): "G'wan, I'm trying to concentrate on a hard problem."

SMOKY: "Yuh must be thinking about your head."—*Eugene Shepard.*

## SCIENTY SIMON, Scientist

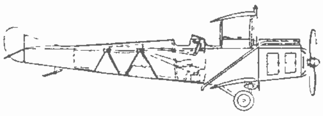
# LATEST PATENTS

## COMPRESSION FAUCET



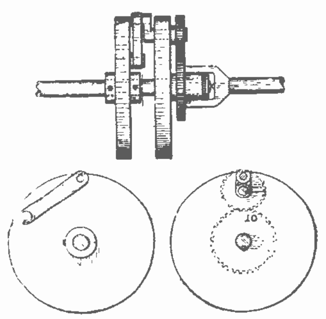
No. 1,619,781, issued to Ernest M. Alfonzo. The device shown here is a compression cap which will efficiently control or stop the flow of liquid therethrough. It consists of a screw portion for attaching a stationary part to its upper end and an aperture at its lower end. A shank is arranged so that it may be rotated in the aperture which has a concave base. The arrangement of washers is such that all leakage is prevented. By means of the compression cap, which may be raised or lowered, the flow of liquid is regulated.

## AIRPLANE SOUND AMPLIFIER



No. 1,581,586, issued to George W. McCauley and Richard W. Mackie. The invention illustrated here shows a sound amplifier adapted for use on airplanes. It consists of a number of funnel-shaped horns directed downward so that sounds may be transmitted from an airplane over considerable distances. A microphone and power amplifier are used in connection with the invention.

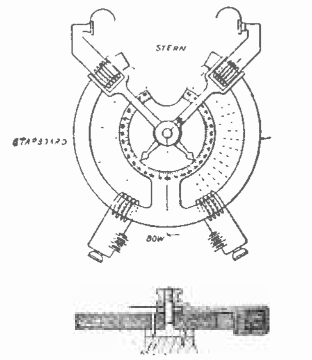
## AUTOMATIC TRANSMISSION



No. 1,632,694, issued to George B. Coleman. The transmission shown here comprises axially aligned driving and driven shafts loosely coupled at their adjacent ends. A cross-head is mounted upon the driving shaft and a bevel gear is secured to the driven shaft. The oscillatory movement takes place axially of the shaft.

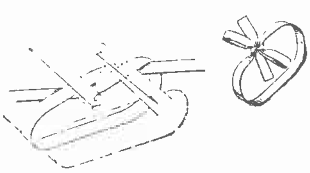
## DIRECTION FINDER

No. 1,581,622, issued to William L. Walker. The apparatus shown here provides a means for comparing the strength of currents and thus determining direction. It consists of a switch whereby movable coils and headphones may be connected in series, each of the coils simultaneously, or one of the coils connected in series with the phones.



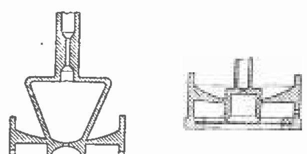

## METHOD OF TYING KNOTS

No. 1,598,310, issued to Thomas A. Quinlan. This invention relates to a simple method of tying bow knots. It consists in combining the opposite ends of a length of ribbon to form a knot, forming the ends into two preliminary loops and crossing the remaining portions of the free ends and then passing each free end through the loop.

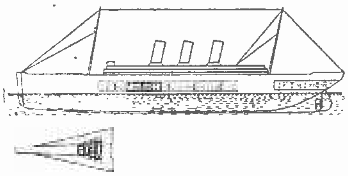


## MECHANICAL VIBRATION

No. 1,618,982, issued to Walter Hahnemann. The device shown below provides a means of sustaining mechanical vibrations with a continuous stream of fluid. A resonator comprising two compartments has a nozzle opening in one of the compartments and a diaphragm connected with the nozzle. A feeding tube is connected to one of the openings in the compartments, and is sub-divided into a number of narrow tubes.

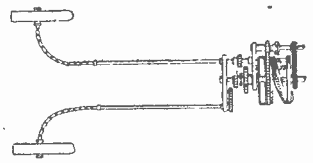


## SHIP



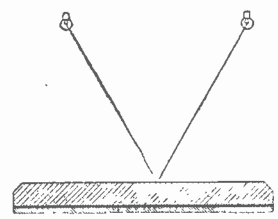
No. 1,623,888, issued to Jerome Pasini. The invention is applicable to any type of boat or ship and provides a novel type of bumper for cushioning the shock of the impact in case of collision. It also prevents the ship from being stove in, in case of collision. The ship has a tapered pocket in its bow and a vertical plate tapered in accordance, one edge of which projects forward and constitutes the prow. A series of cushioning springs are arranged behind the plate.

## MOTION TRANSMISSION



No. 1,616,369, issued to Ludwig Carl Hartmann. The mechanism shown here is used for transferring rotary motion from a high speed drive shaft and for reducing it at a uniform speed which may be varied for imparting rotational movement in different directions. The means for changing the speed ratio between the shafts and the driven shafts comprises a shaft mounted in suitable bearings and a clutch between the shaft and the gear.

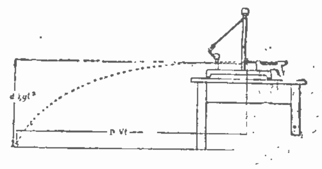
## MIRROR



No. 1,601,597, issued to William Peacock. The mirror shown here consists of a plate of clear glass, the front of which provides the only reflecting surface, the rear face being provided with a light absorbing and non-reflecting coating, comprising a black pigment combined with cobalt blue. This coating absorbs all of the light passing in the rear of the front surface of the glass and prevents the reflection or diffusion of light from the rear face of the glass plate, or from the face of the coating, whereby true, accurate, and well defined images will be reflected at all times.

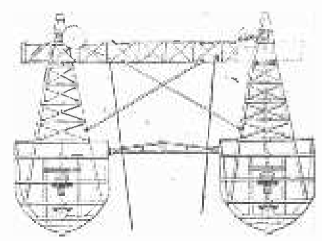
## EDUCATIONAL APPARATUS

No. 1,636,234, issued to Paul E. Klopsteg. The object of this invention is to provide a means for measuring the velocity of a projectile and for illustrating Newton's second law of motion and the conservation of momentum by simple means so that beginners can successfully use it. The apparatus combines a ballistic pendulum with a projectile impeller and a stop mechanism. The ballistic pendulum, including a bob, is suspended by a light rod.



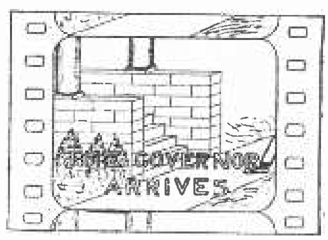
## WRECK-LIFTING DEVICE

No. 1,630,994, issued to Herbert Wicks. This wreck-lifting device comprises a barge or boat with skeleton towers mounted thereon. Hoisting drums are mounted in each tower. The towers themselves are mounted upon movable bases and a bridge crane connects the towers on the barges and also supports the guide drums.



## PREPARING MOTION-PICTURE TITLES

No, 1,564,291, issued to Leland H. Stanford. This method of preparing descriptive titles for motion-picture films consists in enlarging a frame of the film and executing the lettering thereon. The lettered enlargements are reduced to their original size and are then introduced into the film directly preceding the frame from which they were prepared. This enables the presentation of the title that prepares the audience for the scene that is to follow.




NOTICE TO READERS: The above illustrated and described devices have recently been issued patent protection, but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses. —EDITOR.

# THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

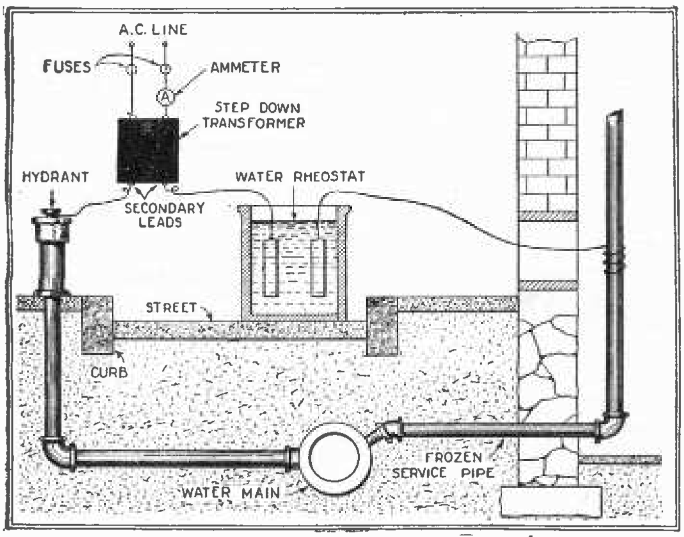
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculation, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

## THAWING WATER PIPES

(2226) C. W. Merrigum, Watertown, So. Dak., asks:

Q. 1. Can you give me some information regarding the thawing of underground water pipes by electricity, using alternating current?

A. 1. On this page you will find illustrated the method most commonly used in thawing out underground water pipes which have become frozen. The principle upon which this method works is the fact that an electric current in passing through a conductor, which offers considerable resistance to its passage, develops a great amount of heat in the conducting material. In passing an electric current through a frozen water pipe there is sufficient resistance encountered to generate the heat necessary to thaw the ice. The ice itself offers great resistance, it being a poor conductor, while the pipe, especially at its joints, offers a considerable amount also. In employing alternating current, it is necessary to use what is known as a step-down transformer. Potentials up to several thousand volts have been used on the primary and transformed generally to about fifty volts on the secondary. The thawing apparatus consists chiefly of this transformer and what is known as a water resistance. The latter is usually in the form of a small barrel filled with salt water in which two copper plates are immersed. By referring to the diagram, it will be seen that this resistance is connected in series with one of the secondary leads. The primary leads are connected to the electric light mains, proper fuses and an ammeter for measuring current being provided. The secondary leads are then attached at either end of the frozen pipe section and the water resistance placed at any point in the secondary circuit with the plates far apart. When it is seen that a larger amount of current is necessary, it may be obtained by reducing the resistance, that is, by moving the plates closer together. Various amounts of current are required, depending upon the condition of each individual piece of work. For service pipes, which are naturally more affected than the water mains, current of an amount of 200 to 300 amperes is generally used. Long leads are used in this work and when possible the connection may be made most easily by attaching one of the secondary leads to the nearest hydrant and the other to a faucet or the piping inside the house. Attention should be given to making a good contact, as a poor connection at either place may result in burning the metal. The workman inexperienced in electrical work should always seek the advice of a competent electrician before doing this class of work, as errors in connections might result seriously.




**At the left is an illustration showing the method used in thawing out underground water pipes by electricity, employing alternating current. In passing the current through a frozen water pipe there is sufficient resistance encountered to generate enough heat to thaw the ice. A number of storage batteries hooked up in series, parallel or other suitable arrangement may also be used for this purpose. This method, of course, is rather expensive, as the storage batteries will have to be recharged about every day. With a step-down transformer, the thawing of pipes is greatly facilitated.**

## THE DRIER IN PAINTS

(2227) Mr. Linley B. Gordon, Albuquerque, New Mexico, writes:

Q. 1. Will you please explain to me the function of a drier in paint?

A. 1. It is a well known fact that linseed oil alone dries very slowly. In paint its drying is sometimes accelerated by the pigment used. Litharge, red lead, and white-lead to a lesser degree, fall into this class of pigment. But for the purpose of bringing the drying period within practical limits liquid drier is added.

A drier is a metallic compound of linseed oil or rosin, termed a resinate or linoleate, as the case may be, to which some linseed oil and turpentine or benzine is added. Those metallic compounds most extensively used contain lead and manganese; although cobalt, nickel and iron are sometimes included. Driers made from rosin (resinates) are generally considered inferior in quality to those made from linseed oil, which contains linoleates.

When we speak of paint drying we really mean that the linseed oil is absorbing oxygen. The oil, on drying, form a solid, tough, leathery substance, in which the pigment is embedded. This combination gives a film that protects the surface to which it adheres.

Linseed oil does not evaporate in the way one might suppose but actually gains in weight while it dries, by the absorption of oxygen. The drier carries the oxygen of the air to the oil at a rate faster than normal, but plays scarcely any other part in the drying process.

The metallic ingredient in the drier is capable of forming two compounds with oxygen. One of these compounds has a surplus of oxygen which is immediately passed over to the linseed oil—a continuous process that keeps up at a rapid rate until finally the linseed oil has absorbed its natural limit of about 20 per cent of its own weight in oxygen. If the action of the drier stopped at this point all would be ideal but unfortunately it does not. The drier keeps right on forcing oxygen into the oil, though at a much slower rate, of course. It is doubtful if this action ever ceases entirely and if too much drier has been used the paint film will be harmed, because the continued addition of oxygen now actually "burns up" the paint film.

It is for this reason that just the right amount of drier should be added, as too much will cause the paint film to deteriorate at a greater rate than normal and too little will mean unnecessary prolongation of the time of drying.

## RECORDING LIGHTNING

(2228) Mr. Frank J. Williams, San Jose, California, asks:

Q. 1. How should records of lightning strokes be made by scientific methods?

A. 1. Although many accounts have been written of the effects produced by lightning, important details are usually omitted, making a scientific analysis of the available information difficult. It is desirable that there be placed on record in an appropriate institution, such as the Weather Bureau of the United States Department of Agriculture, any facts relating to lightning stroke.

It is necessary in making such observations to note carefully many details that often escape attention. Assuming that the object struck is a tree, a plan of the surroundings showing the location of various other trees and objects, their heights, and the position of fallen pieces of the tree struck, should be made. If possible, photographs should be taken from different positions, showing the nature of the damage. All holes, furrows, and other irregularities on adjacent ground should be noted, and their size included. If the tree is splintered, notes should be made of the positions of the most distant splinters, as well as of all the large ones. The nature of the splintering should be noted, as an indication of the path of the lightning. Punctures of the bark should be searched for, even if they are very small. They often show whether the tree was affected by a mechanical force acting from within, outward, or the reverse. Their borders may be scorched. The nature and location of all damage to the bark and sapwood should be noted. Nothing should be moved until everything of interest regarding the original effect of the stroke has been recorded. Then, if practical, the tree may be thrown, so that the roots may be examined and the nature and extent of injury to them, if any, noted. Exhibits should be collected carefully, labeled and preserved.

## THE FLOW OF SAP

(2229) Mr. Arthur J. Clarke, Popocatapetl, Mexico, asks:

Q. 1. How is it that water is made to flow up hill from the roots of plants to their leaves?

A. 1. The ascent of sap in plants is so commonplace an occurrence that we seldom stop to consider what a truly amazing thing it is. Here is an apparent contradiction of the law of gravitation going on all about us all the time. On every summer day, in every field and woodlot, water flows uphill, whether only a fraction of an inch in the humble mosses or a couple of hundred feet in a towering tree. A single full grown maple or linden will evaporate from its leaves as much as a barrel of water in a single day, and this must of course be replaced by sap flowing up the trunk. The water sent into the air by all the plants combined, must be comparable in quantity with the water carried off by the rivers.

How the water gets uphill in the trunks and stems of trees and plants has long been a sore puzzle to scientists. Several theories have been proposed, none of them very satisfactory. Until recently the one most commonly favored was known as the theory of "capillarity," which assumed that the water rose in a stem much as oil rises in a wick, through the natural tendency of liquids to climb up in narrow tubs and crevices. The trouble was, however, that ordinary capillary attraction could not raise water high enough or fast enough to account for all the losses through evaporation and use within the plant.

A comparatively recent development is a theory that seems to explain the phenomena and at the same time to be free from the objections that have overthrown the earlier ideas. This theory is largely the outcome of experiments by a British scientist, Professor Dixon. He found that by sealing a column of water in a glass tube and using appropriate experimental means, he could make the water carry a considerable weight without breaking. Ordinarily, of course, we think of a stream of water as a thing unstable as a rope of sand, but the trick seems to lie in getting rid of all the air; for when this was done the water column could support a strain of several hundreds of pounds per square inch.

This is exactly the condition we find in the stems of plants. The fine fibers of which all stems are largely made up, are really exceedingly slender tubes in which water is carried as sap, but from which all air is excluded. These tubes are connected with each other from the ends of the remotest roots to the edges of the topmost leaves. It is thus possible to think of the evaporation from the leaves setting up a strain or pull on the water in the tubes, which is transmitted as through a system of slender silver wires, drawing the water up as rapidly as it is needed, and even reaching out into the soil in contact with the roots and obtaining a fresh supply from outside.

# Ideal Xmas Gifts

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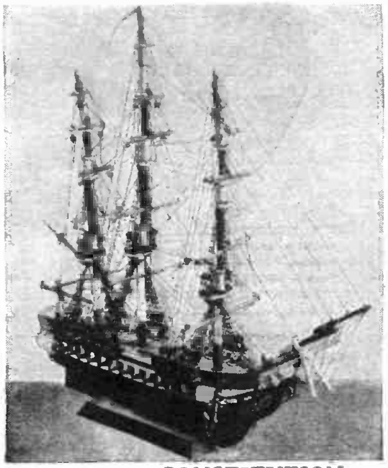

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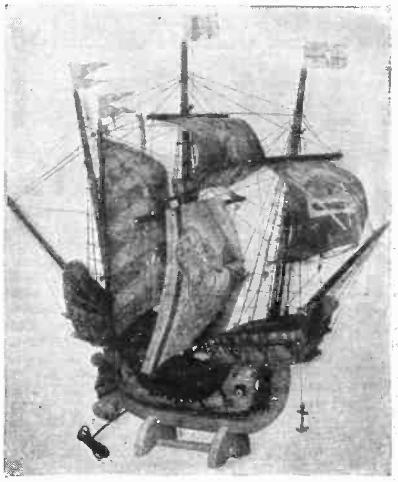

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So clear are the instructions that the 15-year-old boy pictured above won First Prize in a model contest held by the publishers of Science and Invention Magazine. Hundreds of ship models were entered from all parts of the country. This model was constructed from a regular kit of our parts. The educational and historical value a boy gains in constructing one of these models cannot be measured in dollars and cents. Boys like to build things. They learn while they build.

These models, with the exception of the Constitution, may be converted into a beautiful toned loudspeaker that serves a double purpose, being useful as well as beautiful. The mainsail acts as the diaphragm, and is driven by a unit of the electro-magnet type. This is attached to the mainmast, which is imbedded in the hull. Power amplification is not needed, as the unit will operate a 72-in. cone. This assures you faithful reproduction at all frequencies.

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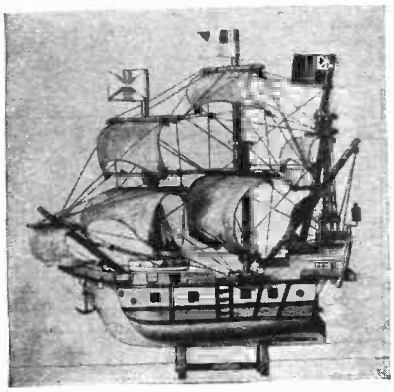

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Please send me complete parts, cut to fit and ready to assemble, for the Constitution, $6.98 ☐; Santa Maria, $4.98 ☐; La Pinta, $4.98; ☐; Mayflower, $4.98 ☐. Melody Ships: La Pinta, $12.50 ☐; Santa Maria, $12.50 ☐; Mayflower, $12.50 ☐. I will pay postman purchase price plus postage (a few cents).
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## Fogs—Menace to Ocean Navigation

By FRANKLIN JOHNSON

(Continued from page 795)

brought about material reduction in the chances for collision.

The separation of the transatlantic lanes was effective as far as it went, but there was still the menace of fogs along the coasts. This was especially true near the British Isles, where the ten-year period ending in 1875 witnessed the loss of 275 vessels in fogs and thick weather. In attempting to lessen this type of toll, the authorities of various governments conducted long-continued tests in sound and flash-light signals. Recent figures show that the seven seas maintain more than 16,000 light and signals under governmental control.

In recent years the radio compass has come into widespread use for the transmission of fog warnings. This device enables a navigator to know his bearings with great accuracy, in harbor or in the vicinity of the coast. The sonic depth finder automatically keeps the master acquainted with his soundings, without the necessity for heaving the lead, or other mechanical sounding. By a combination of appliances the master of a ship may keep to his channel reasonably well in entering the most fog-bound port, secure in the knowledge of what modern science has accomplished.

It is still true, however, that in spite of all the devices provided for minimizing fog hazards, the navigator must take every precaution, and few seamen are willing to run the chances involved in lack of care. The helplessness of navigation was never better illustrated than when a great fleet of ships dropped anchor in New York harbor, in January, 1927, to wait for the lifting of the fog blanket which covered the entire region. None of the navigators was willing to run the risk of proceeding through the blind harbor under the conditions that prevailed, and this, in spite of modern safeguards. The same condition is found on coastwise steamers, when the engines are stopped and the ship is held at a standstill to prevent possible collision. This is of frequent occurrence and is regarded as the safest practice in times of dense fog.

A common cause of fog is the existence of a difference in temperature of water and atmosphere. A fall of two degrees in the warmth of the air is enough to produce fog. Winds are an important factor in creating foggy conditions, because they cause a mingling of warm and cold air above the surface of the water. Marine observations indicate that four-fifths of all sea fogs are caused by the blowing of warm air over water of higher temperature. This is the condition which results in giving the Grand Banks of Newfoundland their ill repute as the home of the worst fogs of the seven seas. The influences which work in this area are those of the Gulf Stream enclosing the cold water from the Arctic, combined with the prevalence of warm winds from the southwest. The summer fogs off the California coast have similar origin through the action of warm winds from the open Pacific mixing with the cooler air overlying the chilly waters along the coast.

Some formations are known as "drift fogs," floating with the air currents. The fog of this type is more dangerous than a stationary field, since it comes on more or less rapidly with the wind, and may envelope a vessel almost without warning while she is moving at full speed. The drift fog is apt to be small in size but large in possibilities for disaster. The danger arises from the circumstances that a ship may enter one side of the "fog ball" while other vessels are entering the opposite side, without any craft

(Continued on page 836)

## Fogs—Menace to Ocean Navigation

(Continued from page 834)

having sighted or heard another. The danger of collision under such circumstances becomes acute before a master can slacken speed or take other precautions.

Similar hazard arises in connection with fog signals from the coast. A drift fog may enwrap vessels before the keeper of a light station or a signal station is aware of its existence. The fact that the keeper does not start his fog signal into action misleads navigators into thinking their ships to be in open waters, remote from the menace of the rocks along the coast line.

A popular belief is that fog is blown away by air currents, and cannot prevail when there is a brisk wind. Observation shows that this is not correct. There are places and times when fog forms or continues in spite of a gale, or even because of the strong wind movement. This is especially true of the vicinity of Point Reyes, California, the windiest and the foggiest summer spot on the west coast of North America. Mariners reported dense fogs during the West Indian hurricane which devastated Havana, October 20, 1926. During this storm the fog prevailed simultaneously with a "whole gale," blowing at from 65 to 75 miles an hour.

There is every reason to believe that in most cases fogs reach only to slight altitudes above the surface of the sea. In many instances, sailors find that a dense fog at the deck level is accompanied by clear atmosphere at the top of a tall mast.

Fogs along the Atlantic coast line may last for long periods. East of Cape Cod the formations have been known to persist for three weeks at a stretch. Even in New York harbor, where there seldom exist more than 10 or 12 days of serious fog in any single year, there was one recent three-day period in which shipping was seriously impeded. During this time scarcely half a dozen sailing vessels entered or left the port, and most of the large passenger steamers were much delayed.

The statement is made that most of the marine disasters on the California coast may be traced to fog as a contributing factor. Numerous shipwrecks are recorded as having occurred during dense fogs at the Golden Gate. Near Humboldt Bay, Eureka Harbor, there are several shoals which are dangerous to vessels in thick weather, and from which it is said that none of the larger steamers, once aground, have much chance of being refloated. Within ten years, up to 1917, no less than 19 vessels were wrecked here because of dense fogs and perilous shoals.

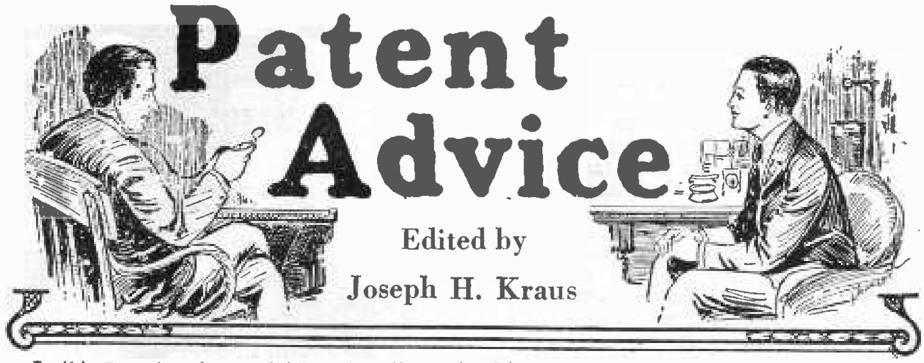
Th vicinity of San Francisco affords unusual opportunity for viewing fogs, especially those of the summer type. The observer notes a great sheet of fog in the early forenoon, lying off the bold headlands on either side of the Golden Gate. As the day wears on the sheet takes on added size. Rising temperature in the warm valleys away from the shore causes the creation of an indraft of increasing force, until early afternoon brings a breeze of 20 miles an hour. Then follows the remarkable spectacle of a cliff of white vapor, perhaps 1,500 feet in height, or even higher, steadily moving shoreward. Advancing past the outer points of land, this cloud keeps coming on until all of San Francisco is enshrouded. Viewed from the weather station on top of Mount Tamalpais, the wall of fog is seen to strike the mountain about halfway up, surging and pearance is so much like that of water that the onlooker is apt to strain his ears in an breaking like a wave of the ocean. Its appearance... effort to catch the roaring sound that seems inevitable.

The menace of fog is increased by a strange phenomenon which deadens the sound of fog horns or other warning signals intended for the ears of mariners. Deflection of sound takes place, producing silent zones, known to sailors as "ghosts," in which signals may go unheard at close range. Such silent zones have been the cause of grave tragedies of the fog belt. An example of disaster from this source was the wreck of the "Galatea," which grounded during a dense fog in a dead calm on Little Gull Island, Long Island Sound. Although the vessel was not more than an eighth of a mile from the shore fog signal, those on board heard no warnings and the grounding was the natural sequel. Investigation proved that the fog horn was in operation when the accident occurred, and that it was plainly heard at Mystic, Conn., 15 miles distant.

An example still more tragic was that of the steamer "Rio de Janeiro," just outside the Golden Gate. After the vessel had remained at anchor all night, the fog lifted at 4 a. m. and the Cliff House Light came into plain view for those on board. Under these conditions the vessel lifted anchor and proceeded toward the harbor, only to be caught once more in the dense blanket as the fog settled down on the surface of the water. Continuing on her course the vessel struck a reef at 5.30 o'clock, sinking 15 or 20 minutes later with the loss of 130 lives.

The action of the silent zone, in this instance, worked both ways. For signals were sounding from three points near at hand but with no sound reaching those on board the steamer. This showed that the "ghost" had blanketed the ship. Further operation of the phenomenon was manifested by the failure of the vessel's powerful whistle to make itself heard at a life-saving station half a mile from the scene of the wreck. The whistle sounded the distress signal at the moment of striking the reef. Had this call been heard by the life-saving crew, the rescue of the entire ship's company would have been a simple matter, as there were no obstacles of wind and wave.

Investigation into the water content of fog produce curious evidence of the slight amount of moisture involved, even when the blanket is most dense. The measurements indicate that less than one-seventh of a glass of liquid water is contained in a block of dense fog three feet wide, six feet high and 100 feet long. This slight quantity of water is so finely divided that there are 60 billion drops in the 1,800 cubic feet in question.



# Patent Advice

Edited by

Joseph H. Kraus

**In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.**

**Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.**

**NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.**

### BED SPRING ADJUSTER

(1063) C. A. Parker, San Francisco, Calif., submits a suggestion for an automatic bed spring adjuster consisting of a bar arranged adjacent to one rail of the bed and coupled with this by means of a worm operable by a handle. This screw is to take up the tension of the springs of the bed which are connected to the bar. He claims greater comfort for the device. He asks our opinion.

A. 1. We do not see that the system outlined by you is of an advantage, as we believe the tension of the springs has but very little to do with the comfort of the individual lying in the bed, providing of course that this tension does not vary within extremely wide limits. Thus a totally slackened spring might produce the effect of a rather rigid hammock, whereas a very tight spring may give a board-like surface, but between these two extremes we believe that the tension of springs would have but little effect on the patient lying on the mattress. One must remember that even though the spring itself may give, the mattress does not necessarily follow its every movement. We would not suggest that you apply for a patent on the idea.

### TUNING CLUTCH

(1064) O. L. Williams, Avon Park, Fla., asks our opinion on an improvement in machine heads for guitars and banjos. By means of a cross bar of metal, he permits the spiral gear on a machine head of a musical instrument to disengage from the key, allowing for freedom of movement of the key and expediting the insertion of the string and the preliminary tuning.

A. 1. We believe that you have designed a rather difficult arrangement for performing a relatively simple function. By means of the slide arrangement you disengage one gear from the other, but there are systems on the market today which enable the key to be turned without this complicated method set forth by you. If the key or peg fits into its gear-housing rather loosely, and is arranged with two studs so that it can be made to lock in that gear, then merely pulling the peg or key free from its encompassing gear enables the key to be turned in any direction, and when pushed down for a distance of 1/16 of an inch, it again meshes with its respective gear. This device will do everything which your device does and possesses the further attributes of ease of construction, simplicity of handling, and cheapness of both manufacture and installation. We would not advise that you apply for a patent.

### SPEEDWAY

(1065) Charles Kubin, Chicago, Ill., submits a drawing of a long spiral speedway so arranged that a hydraulic lift will take an imitation automobile to the top, release the machine and permit it to descend the spiral runway with gradually increasing speeds up to 75 miles an hour. The automobile ride terminates at the bottom. Scenic effects will be used along the run. He desires to know how he can get in touch with a builder or a buyer, whether the idea is new, and desires to have any other suggestions which we may care to make.

A. 1. In the first place the cost of construction of a ride of this nature is entirely too expensive for the thrill which one may experience from the ride, other than the possible thrill obtained from the scenic effects en route. Being a continuous spiral run, one barely notices the constantly increasing speed, not greater at its maximum than the speed obtained in some ordinary scenic railways. The thrill of scenic railways depends greatly upon swift sharp turns and steep ascending and descending trackways. In your system there is no attempt made to even imitate such a condition. The idea is not in any way new and the crash through an imitation stone wall as indicated in your sketches had already been described in SCIENCE AND INVENTION Magazine more than two years ago. We believe this latter suggestion originated in France. The method of stopping is very poor. There will be no tendency of a moving belt to stop the rapidly moving automobile. The automobile will tend to continue forward at a speed of 75 miles an hour even though the wheels themselves may have to travel 150 miles to cover the 75-mile speed. Of course, stopping the mechanism is quite a simple obstacle to overcome. The cost of construction is the item of greatest importance. A tower 200 feet high so rigidly reinforced as to prevent warping of the track could not be made by ordinary construction methods which frequently require the use of wood because of low initial cost. We do not know of anyone willing to undertake the construction of such a device, nor would we suggest that you apply for a patent on the same.

### NON-REFILLABLE BOTTLE

(1066) Owen P. Ferguson, Milford, Mass., asks whether there is any demand for a bottle that cannot be refilled or a seal for a bottle that on being broken would prevent said bottle from being resealed again.

A. 1. Such a thing as a non-refillable bottle does not exist and likewise such a thing as a seal for a bottle which on being broken would prevent the bottle from being resealed again does not exist. While one can drill a hole through the sides of a bottle, and through a suitable cork place wire through the opening thus formed and fasten it together at the top with a seal of certain make or construction, counterfeiting of that seal can easily take place, while it would not pay the average man to do so. If any material were placed in the bottles of a non-refillable nature and it were of benefit to the distributor to refill those bottles, he would do so regardless of their construction. Thus for example, there has appeared on the American market a non-refillable bottle so well designed that it was almost impossible to refill that bottle by any ordinary means. Eventually the system for doing so was fairly well established. This method consisted in placing the bottle in an inverted position in a tank from which the air was expelled. Naturally, the air in the bottle would likewise be withdrawn to an appreciable extent after which the bottle was quickly lowered into the liquid with which the bottle was to be refilled and air was permitted to enter the vacuous chamber. The result was that the liquid rushed upward into the bottle.

A second method frequently employed was to cut out an irregular hole in the bottom of the bottle, fill it up with liquid and reseal the bottle by melting the edges of glass surrounding the opening. Before suggesting further procedure in your case, we would advise that you make sure that the bottle is really what you claim it to be.

## The Metal Emperor
By A. MERRITT
(*Continued from page 799*)

"Brother!" The sweet voice seemed far away, drifting out of untroubled space, an echo of Norhala's golden chimings—"Indeed—all is—well with me—brother."

He dropped the listless palms and faced the woman, tall figure tense, face drawn with mingled rage and anguish.

"What have you done to her?" he whispered in Norhala's own tongue.

The serene gaze took him in, undisturbed by his wrath.

"Done?" she repeated slowly. "I have stilled all that was troubled within her—I have lifted her above sorrow. I have given her peace—as I will give it to you if—"

"You'll give me nothing," he interrupted fiercely; then, his passion breaking through all restraint—"Yes, you damned witch—you'll give me back my sister!"

In his rage he had spoken English, and she could not understand. But the strange stars within her eyes began to glitter as they had when she had summoned the Smiting Thing. Unheeding, Ventnor thrust out a hand, and caught her viciously by one bare, lovely shoulder.

"Give her back to me, I say!" he cried. "Give her back to me, damn you!"

The woman's eyes grew dreadful. Out of the distended pupils the strange stars blazed; upon her face was something of the goddess outraged. Her lips parted—opening to summon her familiars.

"No! No—Norhala! No, Martin!" the veils of calmness that had shrouded Ruth had broken, too; swiftly the girl we knew looked out from them. She struck down her brother's hands and threw herself between the two, arms outstretched.

"Ventnor!" Drake caught his arms, held them tight; "that's not the way to save her, man! For God's sake, be quiet!"

Ventnor stood between us, quivering, half sobbing. Never until then had I realized how great, how absorbing was that love of his for Ruth. And the woman saw it, too, even though dimly, envisioned it humanly. Her eyes, dropping to the girl, lost their dreadfulness and softened. A smile dawned upon the exquisite face, humanizing it, transfiguring it, touching with tenderness the sweet and sleeping mouth.

And on the face of Ruth, as upon a mirror, I watched that same slow, understanding tenderness reflected.

"Come!" whispered Norhala, and led the way through the sparkling curtains. As she passed, an arm around Ruth's neck, the marks of Ventnor's fingers upon her white shoulder stood out, marring it like a blasphemy.

## CHAPTER XIII

### THE METAL EMPEROR

WE stood at the bottom of a circular shaft whose walls were of that same green vaporous iridescence through which we had just come, but finer grained and more compact, as though here the corpuscles of which they were woven were far closer spun. Thousands of feet above us rose the mighty cylinder, and in the lessened circle that was its mouth I glimpsed, faintly, the brighter stars; knew by this it opened into the free air.

All of half a mile in diameter was this well, and ringed regularly along its height by wide amethystine bands—like rings of a hollow piston. They were in motion, spinning smoothly, almost it seemed with the velocity of light. Only one swift glance I gave them, my eyes held by a most extraordinary—edifice—altar—machine?

I could find no word for it—then.

Its base was a scant hundred yards from where we had paused and was concentric with the sides of the pit. It stood upon a thick circular pedestal of what appeared to be cloudy rock crystal, supported by hundreds of thick rods of the same material.

Up from this base lifted a structure of glistening greenish cones and spinning golden disks; symmetrical yet bizarre as the angled headdress of a mountainous Javanese god. In every direction the cones pointed, seemingly interwoven of strands of metal and of light.

What was their color? It came to me it was that of the mysterious element which stains the sun's corona, that diadem seen only when our day star is in eclipse; the unknown element that science has named coronium, that never yet has been found on earth, and that may be force in its one material form; electricity that is ponderable; energy whose vibrations are keyed down to mass; power transmuted into substance.

Thousands upon thousands the cones bristled, pyramiding to the base of one tremendous spire that tapered up almost to the top of the shaft itself. In their grouping, the mind caught calculations each carried out to infinity; an apotheosis of geometry compassing the rhythms of unknown spatial dimensions; concentration of the equations of the star hordes; mathematics of the Cosmos.

From the left of the crystalline base, swept toward us an enormous sphere. It was twice the height of a tall man, and paler blue than any of the metal things I had seen, almost, indeed, an azure. It was different, too, in other subtle, indefinable ways.

Behind it glided a pair of the pyramidal shapes, their pointed tips higher by a yard or more than the top of the sphere. They paused—regarding us. Out from the opposite arc of the crystal pedestal moved six other globes, somewhat smaller than the first and of a deep purplish luster. They separated, lining up on each side of the leader, standing now a little in advance of the twin tetrahedrons.

There they stood—that enigmatic row, intent, studying us beneath their god or altar or machine of cones and disks within their cylinder walled with light.

Norhala threw up both white arms in salutation. From her lips came a lilting theme of the ordered golden chanting.

Was it speech, I wondered? And if so—prayer or entreaty or command?

The great sphere quivered. Swifter than the eye could follow, it dilated, opened.

Where the azure globe had been, a disk of flaming splendors flashed out, the very secret soul of flowered flame. Simultaneously, the pyramids opened behind it into two gigantic four-rayed stars blazing with cold blue fires.

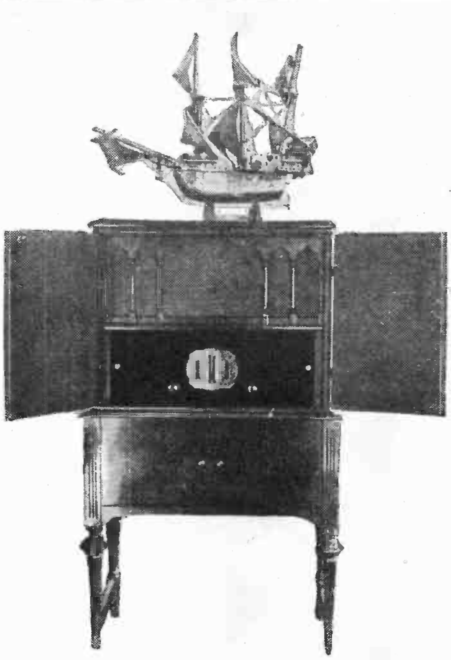
The auroral curtainings flared and ran with streaming radiance—as though some

(*Continued on page* 843)

## The Hayden De Luxe Super

By HERBERT HAYDEN

*(Continued from page 827)*



The completed receiver, in its console, is shown in the above photograph. Note the pleasing appearance when installed in this piece of furniture.

In the February issue of this magazine the author will describe the construction of a power pack to be used in conjunction with this receiver. This eliminator-amplifier is one of the latest to appear on the market and uses two half wave rectifier tubes, which supply the necessary voltage for the proper operation of the receiver and for two type 210 power tubes which are hooked up in push-pull style. The receiver was especially designed for use in conjunction with this power pack, and when both are used together we have what might be termed the "ideal combination," designed for the musical epicure and capable of reproducing the sound of every musical instrument with unusual fidelity.

### TOOL LIST

Pliers, several kinds.
Screw-drivers, several sizes.
Hammer, hacksaw and blades.
Hand drill.
Twist drills, several sizes.
Scriber.
Center-punch.
Soldering iron, electric or other type.
Wire solder, self-fluxing or plain solder and non-corrosive flux.
Rule, steel or wood.
1 three or four-cornered reamer and handle for expanding panel holes for shafts, etc.
1 jeweler's saw.
Small tool and awl handle very useful.
Volt and ammeters for testing set, eliminator, etc.
1 countersink.

## The Metal Emperor

(Continued from page 841)

Spirit of Jewels had entered, jubilant. Norhala's song ceased, an arm dropped down about the shoulders of Ruth.

Woman and girl began to float toward the radiant disk.

The three of us sprang after them. I felt a shock that stiffened every nerve and muscle into helpless rigidity.

Paralyzing that sharp, unseen contact had been, but nothing of pain followed it. Instead it seemed to have created an extraordinary acuteness of sight and hearing, an abnormal keying up of observation, as though the energy so mysteriously drawn from my motor centers had been thrown back into the sensory. Closely, with stereoscopic clarity, I could take in every minute detail of that flashing miracle of gemmed fires and its flaming ministers. Half-way between them and us Ruth and Norhala were now drifting slowly. I could catch no hint of voluntary motion on their part—

**"... As we laid Ventnor upon the pile of silken stuff, Ruth caught my arm with a little frightened cry. Through a curtained door sidled a figure. Black it was and tall. Its long gnarled arms swung apelike ..."**

knew they were not walking, but were being borne onward by some manifestation of the same force which held us motionless.

I forgot them in my contemplation of the Disk.

It was oval, twenty feet in height, I judged, and twelve in its greatest width. One broad band, translucent as sun-golden crysolite, ran about its periphery. Set within this zone, and spaced at regular intervals, were nine ovoids of living light. They shone like sapphires; they ranged from palest watery blue up through azure and purple, and down to a ghostly mauve shot with sullen undertones of crimson. In each of them was throned a flame that was the fiery essence of vitality.

The body of the disc was convex, swelling outward like the boss of a shield; shimmering rosy-grey and crystalline. From the vital ovoids ran a pattern of sparkling threads, irised and brilliant as floss of molten rainbows of jewels. They converged with interlacings of spirals, of volutes and of triangles into the nucleus.

And that nucleus! What was it? Even now I can but guess—brain, in part, as we understand brain, certainly; but far, far more than that in its energies and its powers. And indescribably different in those activities that in our race are termed the cerebral.

It was like an immense rose, an incredible rose of a thousand close clustering petals. It blossomed with a myriad shifting hues. Instant by instant, the flood of varicolored flame that poured into its petalings down from the sapphire ovals waxed and waned.

The heart of the rose was a star of incandescent ruby.

And from flaming crimson center to golden penumbra the disc poured forth power—power vast and conscious!

Not with the same completeness could I realize the star shapes, half hidden as they were by the disc. Their radiance was less, nor had they its miracle of pulsing gem fires. They were blue, blue of a peculiar vibrancy, and blue were the glistening threads that ran down from blue-black circular convexities set within each of the points visible to me. Unlike in shape, their flame of vitality dimmer than the ovoids of the disc's golden zone, still I knew that they were organs even as were those, organs of unknown senses, unknown potentialities. Their nuclei I could not observe.

The floating figures of Norhala and Ruth had drawn close to the disc and had paused there. On the moment of their pausing, I felt a surge of strength, a withdrawal of the inhibiting force. Ventnor broke into a run, holding his rifle at the alert. We raced after him and stopped short, not a dozen paces away from the shining shapes.

For Norhala had soared up toward the flaming rose of the disc as though lifted by unseen hands.

Close to it she swung, her exquisite body gleaming through her thin robes.

Higher she floated, and toward the right of the disc's golden zone. From the edges of three of the ovoids swirled a little cloud of tentacles, gossamer filaments of opal. They whipped out a full yard from the disc's surface, touching her, caressing her. She hung there, quivering, her face hidden from us. Then she was dropped softly to her feet and stood, her arms stretched wide.

And past her floated Ruth—her face ecstatic, as though she were gazing into Paradise, her eyes staring upward toward the rose of splendors through which the colors now pulsed more swiftly. For an instant she hung, while around her head I saw a faint aureole begin to form. She was swung higher, and toward the side, as had been Norhala.

Again the gossamer threads thrust forth and searched her. They ran over her rough clothing. They coiled about her neck, stole through her hair, brushed shut her eyes, circled her brow, her breast. They girdled her.

Weirdly was it like some intelligence observing, studying, some creature of another species—puzzled by its similarity and unsimilarity with another creature of its kind, and striving to reconcile those differences. And like such a questioning brain calling upon others for counsel, the disc swung her to the watching star at the right.

A rifle rang out!

Ventnor had slipped to one side, where he could cover the heart of the disc. He knelt a few yards away, white lipped, eyes cold grey ice, sighting carefully for a second shot.

"Don't, Martin—don't fire again!" I shouted, leaping toward him.

"Stop, Ventnor!" Drake's cry mingled with my own.

Like a darting swallow, Norhala flew to him. Down the face of the disc glided the upright body of Ruth, struck softly and stood swaying, arms wide.

And then out of the blue-black convexity within the upper star point of one of the opened pyramids there darted upon Ventnor a lance of green flame, lightning as real as any hurled by tempest.

The shattered air closed behind the streaming bolt with the sound of breaking glass. It struck—Norhala!

It struck her, and seemed to splash upon her, to run down her like water. One curling tongue writhed over her bare shoulder, leaped to the barrel of the rifle in Ventnor's hands, flashed up to it and licked him. The gun was torn from his grip, and hurled high in the air, exploding as it went. He leaped convulsively from his knee, and dropped.

Past us ran Ruth, all dream, all unearthliness fled from a face now only a tragic mask of human woe and terror. She threw herself beside her brother, peered into his face, felt of his heart; then raised herself upon her knees and thrust out supplicating hands to the shapes.

"Don't hurt him any more! He didn't mean it!" she cried out to them, like a child. She reached up, caught one of Norhala's hands. "Norhala—don't let them kill him! Don't let them hurt him any more! Please!" she sobbed.

I heard Drake cursing.

"If they touch her, I'll kill the woman! I will, by God, I will!"

He strode to Norhala's side.

"If you want to live, call off those devils of yours!"

She looked at him, wonder deepening on

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**Dunninger, who writes exclusively for SCIENCE AND INVENTION Magazine and who is the Chairman of our PSYCHICAL INVESTIGATION Committee, will personally pay $10,000.00 to any medium or spiritualist who can present any psychical manifestation in so-called spiritualism, that he will not explain or that he cannot reproduce by natural means.**

**More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.**

**The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.**

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**So now we have a total of $21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.**

the tranquil brow, and in the clear, untroubled gaze. Of course she could not understand his words, yet she must have understood their menace. But it was not that which made my own sick apprehension grow.

It was that she did not understand what called them forth. Nay, did not even understand what reason lay behind Ruth's sorrow, Ruth's prayer. And more and more wondering grew her eyes as she looked from the threatening Drake to the supplicating Ruth, and from them to the still body of Ventnor.

"Tell her what I say, Thornton, tell her in her own tongue. I mean it!"

I shook my head. That was not the way, I knew. I looked toward the disc, still flanked with its sextette of spheres, still guarded by the flaming blue stars. They were motionless, calm, watching. I sensed no hostility, no anger.

They were as indifferent as we would be over the struggle of an ephemera, and, apparently, as mildly curious.

"Norhala," I turned to the woman, "she would not have him suffer; she would not have him die. She loves him."

"Love?" she repeated, and all her wonderment seemed crystallized in the word. "Love?" she asked curiously.



"She loves him," I said.

Again Norhala brooded over Ruth. Then, with a little despairing shake of her head, passed over and faced the great disc.

Tensely we waited. Communication there was between them, interchange of thought, how carried on I would not hazard even to myself. But of a surety these two—the woman and the wholly unhuman shape of metal, of jeweled fires and conscious force—understood each other.

For Norhala turned and stood aside—

And the body of Ventnor quivered, arose from the floor, stood upright and with closed eyes, head dropping upon one shoulder, glided forward toward the disc like a dead man carried by those messengers never seen by man who, the Arabs believe, bring the death-drugged souls before Allah for their awakening!

Ruth moaned and hid her eyes. Drake reached down, gathered her up in his arms, and held her close.

The gliding body of Ventnor stood before the disc. It swam up along its face. The tendrils waved out, felt of it, thrust themselves down through the wide collar of the shirt. The floating form passed higher, over the edge of the disc until it lay beside the right star point of the rayed shape to which

Ruth had been passing when Ventnor's shot brought the tragedy upon us. I saw other tentacles whip forth, examine.

Then the body was swung down, was borne through the air, and laid gently at our feet.

"He is not—dead," Norhala lifted Ruth's face from Drake's breast. "He will not die. It may be he will walk again. They cannot help," there was a shadow of apology in her tones. "They did not know."

She hesitated, as though at loss for words to express her thought.

"I will take him to my house," she went on. "You are safe—now, nor need you trouble. For he has given you to me for my playthings!"

"Who has given us to you, Norhala?" I asked, as calmly as I could.

"He"—she nodded to the disc, then spoke the phrase that was both ancient Assyria's and ancient Persia's title for their all-conquering rulers, and meant—"the King of Kings! The Great King! Master of Life and Death!"

She took Ruth from Drake's arms, and pointed to Ventnor.

"Bear him," she said, and led us back through the walls of light.

". . . My darkened sight cleared. Where the radiance has gushed stood a gigantic square column, black, like a headless obelisk. It swayed, bowed forward and back. Then from its base blazed blue incandescence with the noise of the shattering of hundreds of panes of glass . . ."

As we lifted his body, I slipped my hand through the shirt and felt his heart. Faint was the pulsation and slow, but regular. Ventnor had medicines, I knew, in the saddle bags. I could attend to him on our way to wherever it was the woman was taking us.

When close to the encircling vapors, I cast one quick look behind me. The shapes still stood immobile, flashing disc, radiant stars and the six great spheres, beneath their geometric, super-Euclidean god or shrine or machine or interwoven threads of luminous force and metal—motionless, still watching us.

We emerged into the place of pillars. There stood the hooded pony, and its patience, its uncomplaining acceptance of its place as servant to man brought a lump into my throat. Salved, I suppose, my human vanity, abased as it had been by the colossal indifference of those things to which we were but—toys.

Again Norhala sent forth her call. Out of the maze glided her quintette of familiars. Again the four clicked into one. Upon its top we lifted the pony, and then the body of Ventnor. I leaped beside him, and began to look through the luggage for the medicine case.

I saw Norhala lead Ruth to the remaining cube. The girl broke away from her, sprang beside me, and, kneeling at her brother's head, cradled it against her soft breast. Then, as I found the hypodermic needle and the strychnin for which I had been searching, I was aware that Norhala stood among us. She had followed Ruth. She stamped a sandaled foot—the cubes quivered and swept away through the forest of the columns.

Unheeding her, blind to all that lay about, heedless of whatever road of wonders we were on, Ruth and Drake and I crouched over Ventnor, striving to strengthen the spark of life so near extinction.

## CHAPTER XIV

### A VOICE FROM THE VOID!

WE had stripped Ventnor to the waist, and while Ruth massaged head and neck, Drake's strong fingers kneeded chest and abdomen. We found no burn, not even upon the hands over which had run the licking flame. The slightly purplish, cyanotic tinge of his skin had given way to a clear pallor. The skin was itself disquietingly cold, the blood-pressure slightly subnormal. I could get no nervous reactions whatever. I am familiar with the effects of electric shock, and know what to do in such cases, but Ventnor's symptoms, while similar in part, presented other features unknown to me and most puzzling. There was a passive automatism, a perplexing muscular rigidity, which caused arms and legs, hands and head to remain, doll-like, in any position placed.

Several times during our labors I had been aware of Norhala gazing down upon us, but she made no effort to help, nor did she speak.

Now, my strained attention relaxing with improvement in Ventnor's condition, I began to receive and note impressions from without. There was a different feeling in the air, a diminution of the magnetic tension.

I smelled the blessed breath of trees and water.

The light about us was clear and pearly, about the intensity of the moon at full. Looking back along the way we had been traveling, I saw a half mile away the vertical, knife-sharp edges of two facing cliffs. We must have passed between them, for beyond were the radiant mists of the pit. On each side of us uprose gradually converging and perpendicular scarps, along whose bases huddled a sparse foliage.

There came a low whistle of astonishment from Drake. We were slowly gliding toward something that looked like nothing so much as a huge and shimmering bub-

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ble of mingled sapphire and turquoise, floating up from earth.

Little turrets, globular and topaz yellow, and pierced with tiny hexagonal openings, clustered about it like baby bubbles just nestling down to rest. Great trees shadowed it, unfamiliar trees among whose glossy leaves blossomed, in wreaths, flowers pink and white as apple-blooms. From their graceful branches strange fruits, golden and scarlet and pear-shaped, hung pendulous.

It was an elfin palace, a goblin dwelling, such a bower as some mirthful, beauty-loving Jinn King of Jewels might have built from enchanted hoards for some well-beloved daughter of earth.

All of fifty feet in height was the blue half-globe. A broad and shining roadway ran up to its wide and ovaled entrance. Along this the cubes swept and stopped.

"My house!" murmured Norhala.

The attraction that had held us to the blocks relaxed, and angled downward through changed and assisting lines of force. The hosts of minute eyes sparkling interestedly at us, we gently slid Ventnor's body and lifted down the pony.

"Enter!" sighed Norhala.

"Tell her to wait a minute," ordered Drake. He slipped the bandage from the pony's head, threw off the saddle bags, and led it to the side of the glistening roadway where thick lush grass, spangled with flowerets, was growing. There he hobbled it, and rejoined us. Together, we picked up Ventnor and passed slowly through the portal.



We stood in a shadowed chamber. The light that filled it was translucent, and oddly enough with little of the bluish quality I had expected. It was crystalline, the shadows crystalline, too; each shadow rigid as the facet of a great crystal. And as my eyes accustomed themselves, I saw that what I had thought were shadows actually were none. They were slices of semi-transparent stone like pale moonstones, springing from the curving walls and the high dome, and bisecting and intersecting the chamber. They were pierced with oval doorways over which fell glimmering metallic curtains, silk of silver and gold.

I glimpsed a pile of this silken stuff nearby. As we laid Ventnor upon it, Ruth caught my arm with a little frightened cry.

Through a curtained door sidled a figure. Black it was and tall. Its long, gnarled arms swung apelike. Its shoulders were distorted, one so much lower than the other that the hand upon that side almost touched the ground. It walked with a curious, crab-like motion. Upon its face were countless wrinkles, and its blackness was the very stain of ancientness. About neither face nor figure was there anything to show whether it was man or woman.

From the twisted shoulders a short, sleeveless red tunic fell. Incredibly old the creature was. And by its corded muscles and its sinewy tendons, as incredibly powerful. It raised within me a half sick revulsion.

But the eyes were not ancient, no! Irisless, lashless, black and brilliant, they blazed out of the face's carven web of wrinkles, intent upon Norhala, and filled with a flame of worship.





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It threw itself at her feet, prostrate, the long arms outstretched.

"Mistress!" it whined in a high and curiously unpleasant falsetto. "Great lady! Goddess!"

She stretched out a sandaled foot, touched one of the taloned hands, and at the contact a shiver of ecstasy ran through the lank body.

"Yuruk—" she began, and paused, regarding us.

"The goddess speaks! Yuruk hears! The goddess speaks!"

"Yuruk! Rise! Look upon the strangers."

The creature she named Yuruk—and now I knew what it was—writhed and, hideously apelike, crouched upon its haunches, hands knuckling the floor. By the amazement in the unwinking eyes it was plain that not till now had the eunuch taken cognizance of us. The amazement fled, and was replaced with hatred.

"Augh!" he snarled, and leaped to his feet. He thrust an arm toward Ruth. She gave a little cry and cowered against Drake.

"None of that—" Drake struck down the clutching arm sharply.

"Yuruk!" There was a hint of anger in the bell-toned voice. "These belong to me. No harm must come to them. Yuruk—beware!"

"The goddess commands. Yuruk obeys."

"That's a nice little playmate for her new playthings," muttered Drake. "If that bird gets the least bit gay—I shoot him, *pronto!*" He gave Ruth a reassuring pat. "Cheer up, Ruth. Don't mind that thing. He's something we can handle."

Norhala waved her hand. The eunuch sidled over to one of the curtained ovals, and through it, reappearing almost instantly with a huge platter upon which were fruits, and some curdy white liquid in bowls of thick porcelain.

"Eat," Norhala said, as the gnarled black arms placed the platter at our feet.

"Hungry?" asked Drake. Ruth shook her head.

"I'm going out for the saddle bags," said Drake. "We'll use our own stuff—while it lasts. I'm taking no chances on what the Yuruk lad brings—with all due respect to Norhala's good intentions."

He started for the doorway, the black blocked his way.

"We have with us food of our own, Norhala," I explained. "He goes to get it."

She nodded, indifferently, and clapped her hands. The eunuch shrank back, and out strode Drake.

"I am weary," sighed Norhala. "The way was long."

She stretched out a slender foot toward the wrinkled eunuch. He knelt, unlaced the turquoise bands, and drew off the sandals. Her hands sought her throat, and dwelt for an instant there.

Down slipped her silken veils, clingingly, slowly, as though reluctant to unclasp her. They fell, whispering, from her high breasts, her delicate, rounded hips, and clustered about her feet in soft petalings, as of some flower of pale amber foam. Out of the calyx of that flower arose the gleaming miracle of her body.

Naked she was, yet clothed with an unearthly purity, protected by some spell of divinity which chilled and slew any flame of desire. A maiden Ishtar, a virginal Isis. A woman—yet with no more of woman's lure than if she had been some exquisite and breathing statue of mingled ivory and milk of pearls.

So she stood for a breath, indifferent to us who gazed upon her, withdrawn, musing, as though she had forgotten us. And that serene indifference, with its entire absence of what we term sex consciousness, revealed to me how great was the abyss between us and her; far greater, perhaps, than that between her and her metal servitors, her metal—lover?

Slowly she raised her arms, and wound the floating tresses into a coronal. Drake entered with the saddle bags, dropped them from hands relaxing under the shock of this amazing tableau, his eyes widened and filled with wonder and awed admiration.

She stepped out of her fallen robes and moved toward the further wall, Yuruk following her. He stooped, raised an ewer of silver and began gently to pour its contents over her shoulders. Again and again he bent and filled the vessel, dipping it into a shallow basin from which came the bubbling and chuckling of a little spring. He slithered to one side, and drew from an ancient chest clothes of white floss, patted her dry with them, and threw over her shoulders a silken robe of blue.

She floated back to us and hovered over Ruth, crouching with the pale head of her brother upon her knees. She made a motion as though to draw the girl to her, and hesitated as Ruth's face set in a passion of denial. A shadow of perplexity drifted through the wide, mysterious eyes, a shadow of pity joined it as she looked curiously down on Ventnor.

"Bathe," she murmured, and pointed to the pool. "And rest. No harm shall come to any of you here. And you—" a hand rested for a moment lightly on the girl's curly head, "when you desire it—I will give you—peace."

She parted the curtains, the eunuch followed her, both were hidden beyond them.

There came a faint rustling from behind those curtains. They swayed. From beneath them spun and glided a score or more of the smallest of the metal things—the Little Ones. as she had called them. Among them was none of the spheres, only the cubes and pyramids. They ran about us, circled and leaped like playful children, peering at us, their myriads of tiny sparkling eyes twinkling. Suddenly they raced toward the doorway, and swept into a circle which revolved with swiftly increasing rapidity.

There was a small wailing, weirdly infantile, a shifting of shape too quick to catch, a blue brilliancy and a tiny crackling. An arrow of phosphorescence flashed up and through the portal. The Little Things were gone.

We sprang to the doorway, and stared out. Something like a tiny azure meteor was speeding through the air toward the gateway of the cliffs. It passed them, and vanished like a shooting star into the radiance beyond.

"A messenger," grunted Drake. "Probably sent to tell the boss she reached home all right with her new—toys. She's—" he paused, gripped my arm, pointed. "Thornton—what's that?"

Out of the vaporous distance another meteor was speeding—toward us. Larger it grew and larger; now it was a wingless dragon streaming sapphire flames.

Forgetful of peril, we ran from the portal, staring upward to watch its passing. Almost overhead its line of flight changed. It spiraled, and then shot vertically downward. There was a dazzling flash. Yet before the flare blinded me, I saw that the flying thing had not crashed as it fell, but had struck with a terrifying, catlike softness.

And down its upright side I thought a great sphere dropped, and glided toward Norhala's dwelling.

My darkened sight cleared. Where the radiance had gushed stood a gigantic square column, black, like a headless obelisk. It swayed, bowed forward and back. Then from its base blazed blue incandescence with the noise of the shattering of hundreds of panes of glass.

The pillar soared upward. It darted like a wingless dragon, back whence it had come.

(Continued on page 853)

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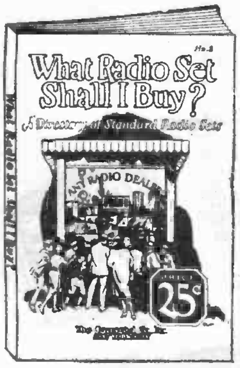


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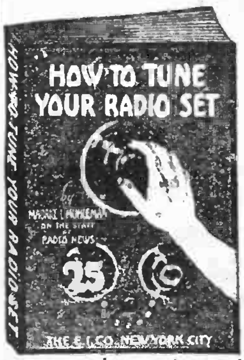


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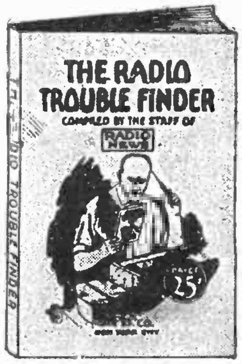


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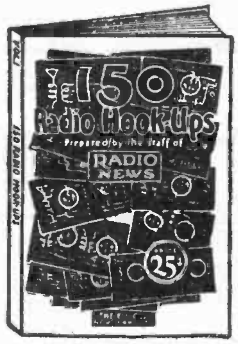


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City, State ..........................................

## The Metal Emperor

(*Continued from page* 851)

It flashed like a blue meteor through the gateway of the cliffs and vanished, as had the tiny javelin of the little things, in the vapors.

I remembered the shape I thought I had seen slip down from it.

"Quick! To Ruth!" I set off at a run to the house. We raced through the door—and with a sob of relief found her as we had left her, brooding over her brother.

"Ruth," I panted, " did anything come in here?"

"No." She raised surprised eyes. "No—I saw nothing. There was a strange noise, and a light flashed through the door—that was all—"

A groan from Ventnor interrupted her. His mouth was opening, slowly, slowly—with an effort agonizing to watch. Then his voice came through lips that scarcely moved. Faint, faint as though it floated from infinite distances—a ghost of a voice whispering out of a dead throat.

"Hard! So hard!" the whisper complained. "Don't know how long I can keep connection—with voice. Can't tell whether speaking—or thinking. Words and thoughts so much one, where I am—can't tell—you have to piece out what I say.

"Was fool to shoot. Sorry—might have gotten you in worse trouble—but crazy with fear for Ruth."

The thin thread of sound ceased.

"Martin!" I called, bending over him. "It's nothing, old friend. No one blames you. Try to rouse yourself."

"Dear," it was Ruth, passionately tender, "it's I! Can you hear me?"

"Only speck of consciousness, and motionless in void," the whisper began again. "Terribly alive, terribly alone. Seem outside space, yet—still in body. Can't see, hear, feel—short-circuited from every sense—but in some strange way realize you—

"See without seeing—here floating in darkness that is also light—black light—indescribable. In touch, too, with these—"

Again the voice trailed into silence. It returned, word and phrase pouring forth disconnected, with a curious and turbulent rhythm, like rushing wave crests linked by half-seen threads of spindrift; vocal fragments of thought swiftly assembled into a coherent message.

"Group consciousness . . . gigantic . . . operating within our sphere . . . operating also in spheres of vibration, energy, force . . . above and below one to which humanity reacts . . . perception, command forces unknown to us . . . but in greater degree-cognizant, manipulate unknown energies . . . senses unknown to us . . . unknown . . . even to those known profoundly modified by additional ones . . . metallic, crystalline, magnetic, electric . . . consciousness basically same as ours . . . profoundly changed by differences in mechanism through which it finds expression . . .

"Getting clearer . . . see more clearly . . . see . . ." the voice shrilled out in a shuddering, thin lash of despair—"No! No—oh, God—no!"

Then clearly and solemnly:

"And God said: let us make man in our image, after our likeness, and let them have dominion over all the earth, and every creeping thing that creepeth upon the earth."

And now distinctly, unfalteringly, the voice went on:

"Dominion over all the earth? Yes—as long as man is strong enough to rule; no longer. Science had warned us. Where was the mammal when the giant reptiles reigned? Slinking hidden and afraid in the dark and secret places. Yet man sprang from these skulking mammals.

"For how long a time in the history of earth has man been master of it? For a breath—for a cloud's passing. And shall remain master only until something grown stronger than he wrests mastery from him—even as he wrested it from his ravenous kind—as they took it from the reptiles—as did the reptiles from the giant saurians—which snatched it from the nightmare rulers of the Triassic—and so down to whatever held sway in the murk of earth dawn.

"Life! Life! Life! Life everywhere struggling for completion! Life crowding other life aside, battling for its moment of supremacy, gaining it, holding it for one rise and fall of the wings of time beating through eternity—and then—hurled down, trampled under the feet of another straining life whose hour has struck!

"Life, crowding outside every barred threshold in a million circling worlds, in a million rushing universes.

"And these—these—" the voice suddenly dropped, "over the Threshold, within the House of Man. These—Things of metal whose brains are thinking crystals—Things that suck their strength from the sun and whose blood is the lightnings!

"The sun! The sun!" he cried.

The voice rose in pitch, grew strident.

"Go back to the city! Go back to the city! They are not invulnerable! No! The sun—strike through the sun! Norhala! Norhala is their weakness. His weakness. Norhala! Go back to their city—"

A faint tremor shook him; slowly the mouth closed.

"Martin! Brother!" wept Ruth. I thrust my hand into his breast; felt the heart beating—slowly, but regularly, with a curious suggestion of stubborn, unshakable strength, as though every vital force had concentrated there as in a beleagured citadel. But Ventnor himself, the consciousness that was Ventnor was gone. It had withdrawn into that subjective void in which he had said he floated—a lonely sentient atom, his one line of communication with us cut, severed from us as completely as though he were, as he had described it, outside space.

And white-faced, Drake and I gazed deep into each other's eyes, neither daring to be first to break the silence of which the muffled sobbing of the girl seemed to be the sorrowful soul.

*(To be continued)*

(SECOND SERIAL RIGHTS)

## BOOK REVIEW

THE AMATEUR CHEMIST, October 1927, edited by William B. Thompson, paper covers size 6"x9". Published by Thompson Allen Laboratories, Shamokin, Pa. Price, 10c per copy, $1.00 per year.

This interesting magazine should appeal to the chemist and amateur experimenter inasmuch as it contains many experiments and laboratory hints which will be found useful, as well as instructive. There is also a monthly Experiment Contest for which three prizes are given. Besides this, a story contest is held each month and a prize is given for the best chemistry story not over 500 words. Back issues of this valuable booklet may be obtained from the publishers.

THE BOY'S BUSY BOOK. By Chelsea Fraser, stiff cloth covers, 8"x6", 480 pages, profusely illustrated. Published by Thomas Y. Crowell Co., New York. Price $2.50.

The author of the book gives to the boy a large amount of useful material for his work shop. The text tells how tools are taken care of and how to build and install a work bench in the cellar or garage. By simple worded text and many diagrams, the book shows how to make simple articles of furniture, things for the kitchen, toys and games and many other articles of wood. Special chapters are devoted to work in paper, cement, metal, and leather so that the boy will find a number of outlets for his talent.

## Growing Living Chemicals

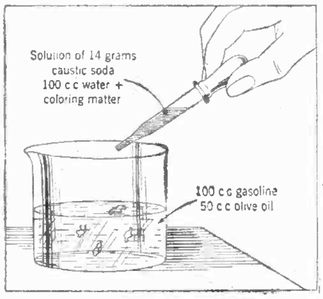
By MAYNARD SHIPLEY

(Continued from page 806)

Herrera even claims that if stearic acid be used instead of olive oil, not only will these artificial amœbæ display enormous activity, but they will seem, at least, to flee from danger—say a needle inserted in the mixture and moved about by the observer!

He states also that on one occasion he distinctly saw a small colpoïde, pursued by a larger one, make apparently purposive efforts to escape it.

Dr. Herrera's first experiments were made under high pressure. The results were so interesting that he began to experiment for the purpose of finding chemical combinations that would give the same effects under ordinary atmospheric pressure. India ink in gasoline was his first simple mixture; then, thinking that too artificial, he tried an aqueous solution of soda, mixed with coloring matter, in gasoline acidulated with hydrochloric acid. This was not sufficiently soluble in the gasoline, so he substituted acetic acid. Then he hit upon olive oil, with remarkable success. However, all sorts of combinations are possible, the alkaline solution being modifiable in many ways. More and more he is attempting to approach the composition of the natural living cell. The whole phenomenon depends upon osmotic pressure, the oil and gasoline penetrating the soapy drops. The colpoïde moves by the breaking or lessening of the superficial tension, and the consequent ruptures of equilibrium due to successive deformations. The vacuoles are formed by excess of liquid.




**The diagram at the left indicates exactly how the chemicals are added to the olive oil and gasoline to produce the effect of living colpoide.**

Nevertheless, if such effects—movement, irritability, fission, assimilation, even a sort of primitive purposiveness—can be secured by such simple means, why, asks Dr. Herrera, may this not be the manner in which living organisms *were* first produced? Why may we not have invaded a "protobial" realm where non-living matter is preparing for its transformation to living matter!

Dr. Herrera thinks we have; and on the basis of that theory he has built up an immense system which he calls *Plasmogeny*, and which is the foundation of two great works, the later, "A New Science: Plasmogeny," having been published at Barcelona in 1926. He relates his discovery to every field of science—astronomy, physics, chemistry, biology, even sociology and philosophy. Most of his work has been published in Spanish; some of it in French and Italian technical journals; very little of it in English. But he has been recognized by scientific bodies all over the world, and Societies of Plasmogeny exist in France and Spain.

In any event, whether one follow him in his theoretical excursions or not, the wonderful artificial cells may be reproduced by any amateur chemist at will, and are among the most astounding and exciting experiments that one could undertake.

## Automatic "Policeman" Directs Traffic

By DOROTHY SHRENE

(*Continued from page* 806)

The light switches at the top of the box care for the general timer, lights, flasher, and bells.

The principle of control of the general speed of rotation of the signal hands lies in the little saw-like lever above noted, which, by moving the time control lever on the switchboard, changes its position on the face of the revolving cam, moving in a wider circle if "slow" is desired, or nearer the center of the cam, if the speed is accelerated, the idea being, that, the closer to the outer edge the control moves, the slower the motion of the cam, since the lever travels a longer distance. These speed controls are a special Waterhouse patent.

The head of the signal is in itself a traffic warning, bearing mute testimony even if not working, that here is located a corner sufficiently dangerous to have a traffic regulator installed. A bell of warning sounds just before the signal changes, and, if at night, a red or green light immediately follows. Almost at once the signal rotates and the proper warning takes its place upon the dial. Motorist and pedestrian simply obey what they see and hear. The presence of a traffic policeman is unnecessary, except perhaps upon the busiest corners.

The excellent features of the Waterhouse Signal, and those which render it different and superior to any other signal, lie in its automatic construction as well as in the outward appearance of the semaphore, which has been noted. The construction is simple, providing for its complete continuous operation, and the swift removal or interchange of all units, which may be serviced in the shop, where they are made. All controls and switches are located in a single box at each intersection, and are adjustable automatically or by the officer on duty there. The cost of installation is less than 1/3 of that of the traffic signals now most generally used, and the expense of operation only one cent per hour per intersection, computed at a five cent K.W.H. rate. There is a clearance period between bells, when the signal hesitates for an automatically designated period, thus protecting the pedestrian. The clearance period may be regulated automatically, as described, to increase or lessen the time between bells, either by local regulation, or from a central station. The intervals may be longer upon the main line of traffic, and short in the signal controlling the crossection traffic, if desired.

Porcelain flags enameled with GO and STOP in black and red, revolve against the white enameled disk, which is 29 inches in diameter, and is covered with 1/4 inch plate glass.

Mr. Waterhouse further described the running mechanism in regard to its removal and oiling as follows:

"The unit that rotates the disc in the head is a simple, compact mechanism, easily removable, and provided with large wick oilers making it unnecessary to oil frequently. The mechanism is removed by merely turning an eccentric catch and removing two plugs. The reducing gears and ball bearing thrust bearings run in oil, thus greatly reducing the friction and wear. This very vital mechanism is so simple that there is very little chance for it to get out of order."

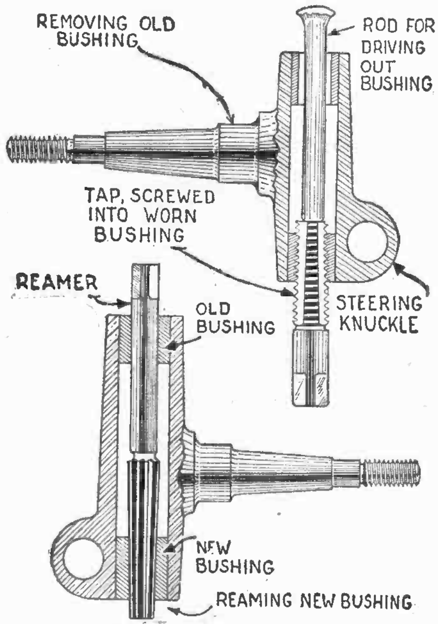
The two motors used in the operation of the semaphore are a small electric motor, about 1/1000 H.P., and a head motor, of 1/30 H.P.

The principle of the new traffic signal is so like the old, that their introduction has not the effect of confusing the driver or pedestrian accustomed to the usual type of signal.

## Motor Hints

(*Continued from page* 809)

These methods make a good serviceable repair or renewal, which otherwise, by reaming the bushings without guiding the reamer, result in loose and ill-fitting bushings.




The method of reaming bushings is shown here.

## Metered Telephone Conversation

(*Continued from page* 807)

eight in the evening and eight in the morning the length between the changes of polarity is lengthened to thirty seconds, thus giving half rates during the periods of less use. The Telechrone being two full minutes of four thirty second Telos instead of the fifteen second Telos. The device is simple and effective and is controlled by an electrically wound clock which makes all compensations for the time changes. The line may be used with the automatic call system and has made it possible to establish extremely low rates that tap a class of service that heretofore could not afford telephone service.

The minimum rates begin with a monthly minimum of $3.00 per month for a one-party line and go down to $1.50 per month for the ten-party lines. After the minimum rates have been absorbed the cost of the service starts with a charge of nine mills per Telechrone of service and falls rapidly to three mills per Telechrone. The new system has eliminated the long, drawn-out conversations and has proved highly successful.

After being in actual operation for a year and weathering a long investigation by the University of Washington and the Washington State Department of Public Works and a severe investigation and criticism by the telephone trust, the Telechronometer, as the device is known, is now in full operation on the telephone system of Everett, Washington, a city of thirty thousand people, and has made unusual records. The number of subscribers has doubled and the rates are much lower than the average flat rate scale. It was invented by Mr. Charles M. Beattie, of Rochester, N. Y., and perfected by Garrison Babcock, of Seattle, and the control of the device now rests with the American Telechronometer Company of Everett, Washington.

## Why Birds Migrate

By DR. ERNEST BADE

(*Continued from page* 787)

and long drawn out flights to satisfy their hunger. Only for the purpose of nesting were these long flights interrupted, but they began again as soon as the young could take care of themselves.

Such long drawn out flight became, throughout thousands and thousands of years, more and more regular in character, a regularity brought about by the changes of our earth as ice period followed ice period. The northern flight in fall and the southern flights in spring were soon found to be too dangerous and entirely wrong, and so the northern flight was undertaken by the survivors in spring and the southern flights in the fall. As the birds became more and more used to the regular changes in climatic conditions, conditions not in existence in their early struggles, they remain for longer and longer periods in their various haunts, only migrating as the seasons changed.

Such instinctive actions are more or less controlled by sense, and therefore it is natural that one or the other species successfully withstood the urge to migrate and remained, even in the more unfriendly seasons, in one location. It is thus that certain birds are found in one region throughout the year while others migrate. Of course there is an intermediate bird, a bird that does not migrate and that does not remain in any one region. It is a *hobo*, and he is always traveling, always on the go, never satisfied with any location and always wants to find out what is on the other side of the hill.

| Migratory Birds | Wanderers | Non-Migratory Birds |
|---|---|---|
| Swallow | Junko | Sparrows of all types |
| Cat bird | Waxwing | Wren |
| Robin | Snowflake or | Crow |
| Virio | Snow bunting | Starling |
| Cardinal | Redpoll | Blue jay |
| Tanager | Crossbill | Sand piper |
| Oriol | | Brown creeper |
| Warbler | | Woodpeckers |
| Thrush | | Chickadee |

These are some of the commoner types of birds classified according to their habits.

**Radio Wrinkles Wanted!**

The Radio Editor, Mr. Paul E. Welker, wants to hear from you, if you have a good idea or wrinkle. Make a pencil or pen and ink sketch of the contrivance, write 50 words or so of description, and mail to the Radio Editor, c/o this magazine.

## Readers Forum

(*Continued from page* 823)

while other parts float aimlessly among the undersea peaks and valleys."

**(These statements are wrong, as wooden and lighter articles would float to the surface, while the heavier metal sinks to the bottom.—EDITOR.)**

"At 600 fathoms the temperature of the water drops to 35 degrees. Thereafter, down to a depth of five or six miles there is an additional drop of only about one degree. This coolness, only three degrees above the freezing point, is due partly to the absence of the sun's rays and partly to the existence of polar and sub-polar currents which have spread over the valleys and sunk to the depths, carrying with them sufficient air to sustain the marine life."

**(The freezing point of sea water is 27 degrees Fahrenheit. Consequently, sea water can be colder than fresh water before developing its maximum density.)**

"The pressure at six miles below the surface of the ocean is five tons to the square inch **(about seven—Editor)**, or enough to crush in the sides of the motors of the planes, provided they contain any air resistance. Steel tubes sent down to plumb the depths have come up flattened, with the thermometers inside them reduced to a fine powder. A body sunk to 5,000 fathoms would have every bone broken before it reached the bottom, and be so driven into itself by implosion that it would be no thicker than a man's wrist."

**(It does not necessarily follow that a man should be compressed by being lowered to a great depth. The tissues of the body are quite yielding, and it is very probable that the water will penetrate into the nasal cavities and lungs, producing a counter-pressure against the water on the outside. Those of us who exist in this world have a pressure of 14.7 pounds per square inch acting upon our bodies constantly. Nevertheless, man does not suffer "implosions." If this pressure is increased to even as much as 75 pounds per square inch, the tissues can still withstand it. It is the rapid change from great pressure to the atmosphere that produces "the bends."**

"The tissues of the deep sea animals which gaze wonderingly at the wrecked planes are forced to resist this enormous pressure. Some of these animals are so soft that they disintegrate when hauled into the air."

**Yes, most deep sea animals disintegrate when they are hauled up into the air, unless this is done with extreme care. Sometimes the animals are trapped in steel cases and then brought up under pressure, dropped into a glass tank and the pressure there again increased so that their habits and reactions can be observed. At other times, these animals are brought up very slowly, so that they gradually become accustomed to changes in water pressures. Like the human body, the deep sea fish resist the enormous pressure because the pressure acts equally within and without and in all directions. They are just as soft as any other fish. It is for this reason that they burst when brought up into the strata of much lessened pressure, because of the expansion of air within them. So will a rubber balloon burst when put in an evacuated chamber, because of the pressure relief.**

**One must not expect every journalist to be a technical man.**

## Making a Phonograph Pick-up

By WALTER E. BURTON

(*Continued from page* 828)

as a volume control, as shown in the illustration. Vibrating of the diaphragm in the field of the permanent magnets of the unit sets up tiny electrical currents in the magnet coils. These currents are amplified by the audio frequency system. Adjustment of the air gap between the diaphragm and magnets should be made so that maximum quality is obtained. Radio frequency tubes should be turned off when the pick-up is in use.

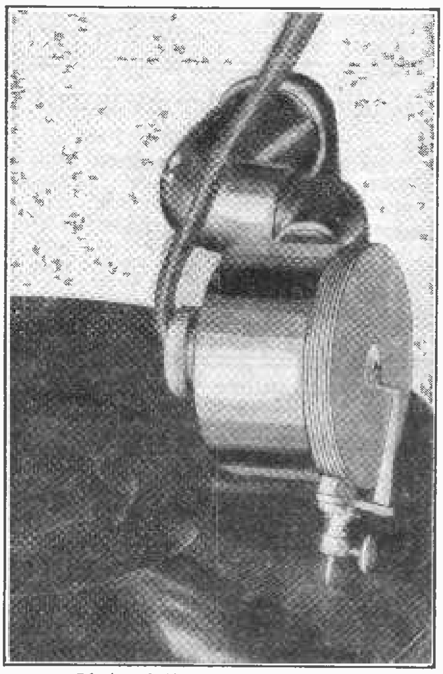


Photo of the Finished Pick-up.

## "Fingerprints" That Guns Leave

By PHIL M. RICHARDSON

(*Continued from page* 788)

on be connected to the gun that fired it.

The first is left by the firing pin which by wear gradually accentuates the peculiarities that are always there.

The second is left by the breech block against which the shell is forced after the bullet leaves the gun. Since the surface of the breech block is filed by hand no two shells will have the same imprint.

The third is left on the jacket of the shell by little peculiarities of the cylinder when the shell is ejected.

The last one is left by the ejector which grips the shell and forces it from the gun. In the guns where ejectors are used it will be found that the ejector has its own characteristics so that it is easily identified.

| Grooves | Twist* | Make | Remarks |
| --- | --- | --- | --- |
| 5 | R | S & W | Lands much wider than Rem. or Colt |
| 6 | R | S & W 32 DA & safety | Same as above |
| 6 | R | S & W 45 | Made for Government in war |
| 6 | R | S & W 22 Auto. | Very few marketed |
| 6 | R | S & W 35 Auto. | Very few marketed |
| 6 | L | Colt Auto. | Twice as wide as Rem. |
| 6 | R | Savage Auto. Pistol | Width of grooves is .115-inch in the 32; .125 inch in the 380. Width of the lands is .047, o nearly twice that of the Rem. |
| 7 | R | Rem. Auto. | Narrow lands. Colt 380 lands are .062 in. wide Rem. 380 lands are .025 in. wide. |

* R—right; L—left.

## Metal Airplane Wins S. & I. Trophy

(*Continued from page* 814)

It is quite obvious that many different tools could be used in the construction of this airplane. Likewise much of the work can be done with but very few tools. The following list may be of considerable value to the builder.

| | |
| --- | --- |
| 1 pair of pin shears. | 1 can of glue. |
| 1 soldering iron. | Several brushes. |
| 1 hand brace. | Ivory, green, red, white and blue paints. |
| 1 set of drills. | A lathe can be used to good advantage. |
| 2 chisels. | |
| 1 or more hammers. | |
| 1 pair of side-cutting pliers. | |


**Have You Read the "Hints for the Mechanics" Department**

**SEE PAGE 819**

**Send in your ideas to the Editor of that Department**

## The Astrology Humbug

By JOSEPH H. KRAUS

(*Continued from page* 808)

cution. And for the sake of argument, let us assume that this is the date that matters; the same birth time and place having been given to all of the astrologers it is perfectly natural that if astrology were a science, each and every astrologer should erect the same type of a horoscope and should produce the same finding.

". . . . All his sicknesses are arising from the condition of his mind and nervous system. The mental impressions cause troubles affecting the mind. The sicknesses have an acute character. The morbidness indicates a tendency to peculiar stomach complaints likely to become incurable. Hypnotic treatments or operations are here not advisable, but suggest extraordinary methods as electrical or magnetic. This sickness in the stomach has nervous character and gives convulsive aches.

"The important event occurred July 30, 1915: the heavy and death-dangerous sickness in the stomach or nearly of it. . . ."

**Excerpted from the horoscope submitted by**
Josip Vàora,
Yugoslavia, S. H. S., Europe.

". . . . There is an error either in the statement of the correct birth hour; dating important events on July 30, 1915, or the mathematical calculations of the astrologer.

"The important event according to data on hand occurred in 1916, and involved the loss of a very dear member of the family, either by death or a divorce, followed by a financial crash, social slanders and disbarment, and a great danger of imprisonment but for the helpful influences of some in high authority. Again the wealthy woman appears with ready cash and help. This trouble has been brewing for three years previously, and the date stated is the climax of the aspect.

"An inheritance at about this time also involved litigation and loss. Health breaks, with a resultant retirement from the active affairs of life, and a quiet devotion to literary effort affords a livelihood. . . ."

**Excerpted from the horoscope submitted by**
Chas. H. Texter,
Quakertown, Pa.

". . . . Marriage is not a major event of such a nature that the native will have no control over the outcome of the same.

"The inquiry into the duration of life of subject 'Y.' the writer judges from the planetary configuration shown in the horoscope that the subject is living. His demise will not occur yet for a few years. . . ."

**Excerpted from the horoscope submitted by**
W. Helios,
Logan, Utah.

". . . . This man has broad, humanitarian tendencies, and under an abrupt, dominating exterior, he is sensitive, sympathetic, charitable and impulsive, always ready to help those in distress, yet always has had a tendency to use good judgment.

"He has had good health and unusual vitality, subject of course to occasional illness. He would be most liable to stomach and heart troubles, or even apoplexy.

"All of his endeavors and interests have been characterized by enthusiasm, and his most prominent trait, that of a desire to rule, to be at the head of anything with which he was connected. . . ."

**Excerpted from the horoscope submitted by**
E. J. Porter,
San Francisco, Calif.

". . . . There is a possibility that the subject died or came near to it on the date mentioned, 1915.

"The subject is courteous, trustworthy, prophetic, interested in occult thought, domestic concerns; friends of noble birth play an active part in the life; the religion is changeable, tending towards intellectuality and psychic paths at the close of life. . . ."

**Excerpted from the horoscope submitted by**
Helen Joyce,
Indianapolis, Ind

". . . . In addition to this bad aspect, the erratic planet Uranus came to an opposition of Mercury on January 5, 1913, and on January 25, 1913, to an opposition of the sun. All this with Neptune still adverse to Uranus, must have given the subject an awful period. Uranus remained in opposition to sun and Mercury off and on by direct and retrograde motion up to October, 1913.

"Through 1914 conditions must have been a little more hopeful, as Jupiter made good aspects to Saturn and his own place at birth through May and June, but on Agust 27, 1914, with Saturn, by transit, entered the sign Cancer in conjunction with Venus, and was in conjunction with Mars on September 15. By retrograde motion these aspects operated again on November 12 and December 3rd. As Saturn rules the 12th house of the chart, as well as Uranus, this aspect was restrictive and limiting. Saturn and Mars usually bring some tragedy in the life, often imprisonment.

"Uranus continued to transit the ascendant through 1915, and, assuming the birth hour to be correct, early on the day of July 30, 1915, Saturn was 9 degrees and 58 minutes in Cancer, and within two minutes of a square or unfavorable aspect to the house of death. If the birth hour was just a minute or so later than 8:10 P. M., the aspect was in exact degree to Libra 10 degrees on house of death. Neptune at the same time was 24 minutes in Cancer just past a conjunction of Venus. My judgment is that the subject met a violent death on that day either by his own hand or the hand of another. . . ."

**Excerpted from the horoscope submitted by**
Martin Petry,
Bronx, N. Y.

". . . . The event of 30th July, 1915, for this native (Y) was no doubt a very unfavorable one. Mars being on this day in 17 degrees of Gemini over Jupiter in his horoscope, Mercury and Venus in Cancer near the Moon. Jupiter retrograde and the Moon close together in the last degrees of the Pisces on the 30th of July, both in square to Venus and Mars which is no doubt rather bad. Uranus near the ascendent and retrograde points to a sudden mishap—the connection Sun Neptune further indicates confusion, embarrassment and bewilderment. (The planets on this unhappy day I have marked with brown color near the center of the circle.) It is not easy to exactly tell what happened in these days, but there is a possibility of a sudden mishap and illness, as on this particular day so many planets happen to gather round in the sign of Aquarius, even in the Radix-Horoscope too. May be that the mind or soul was attacked and sick, possibly caused by love matters or erotic affairs (5th house heavily engaged and the 8th house in sign of libra of Venus-character.) Further Saturn badly afflicted in Saggitarius sometimes suicide happens. Some further predictions in this particular respect are mentioned in the 3rd horoscope which shows some remarkable and close connections with this present (2nd) nativity. . . ."

**Excerpted from the horoscope submitted by**
Emil Saenger,
Berlin, Germany.

". . . . He was much interested in the army or navy and likely to have gravitated into the service, with resulting damage to his person. . . ."

**Excerpted from the horoscope submitted by**
C. E. S. Burnley,
Alameda, Calif.

". . . . This man was born with Aquarius rising with a much higher state of mentality than the average of this sign. This sign is ruled by Uranus, the planet of great extremes. With all the qualities of a scientific mind, known for its quickness and alertness, to express good judgment for others but you lack that same quality in judgment of your own monetary aspects, of which he has no better control than the wind. He will take great pleasure in the exploration of any scientific subject and loves to undermine anything he does not like.

"At the age of 16 I find him under the struggle of an enterprise followed by great success with marriage to the age of 21 with a separation this same year and a downward slide to the age 26, 1896, when he knew what poverty meant. In 1898 was a change for the better with another love affair coming on. When he reached the top again at 31, 1901, 1903 was not very good where in 1904 he met with a crash that he will never forget. 1905 a little change for the better. 1907-1908 another setback with sorrows and troubles. 1910 better. 1911-1912, bad with an accident that will leave a scar. 1914 better, 1915-1916 another setback, 1919 good, struggling with something new under all kinds of oppositions until 1926 when he realized a success.

"The year of 1927 came in good. A little trouble by trickery of a friend about January 21st April 2nd the temper high over some little irritation. June 11th irritation from a woman. August 28th trouble and disappointment to September 5th with a woman.

"He should remember this latter incident. These aspects do not amount to anything but it is all I can find this year. He did not feel very well September 11th, also last Sunday, September 25th, was not a good day, a restless state of mind. . . ."

**Excerpted from the horoscope submitted by**
Charles P. Mason,
Brookline, Mass.

**We leave it to the reader to guess as to whether or not there is any truth in astrology. You have just read excerpts from a few of the many letters which we have received. You see that the major event given by us was not even hinted at in any of the letters. As a matter of fact, the majority of astrologers would have us believe that this man convicted of murder was an honest, polite, courteous, subtle, cheerful, etc.; that he would do nothing except benefit society, friends, servants, subordinates and be in the public's eye constantly. The above statements are the consensus of opinion, they are not exactly quoted from any individual letter.**

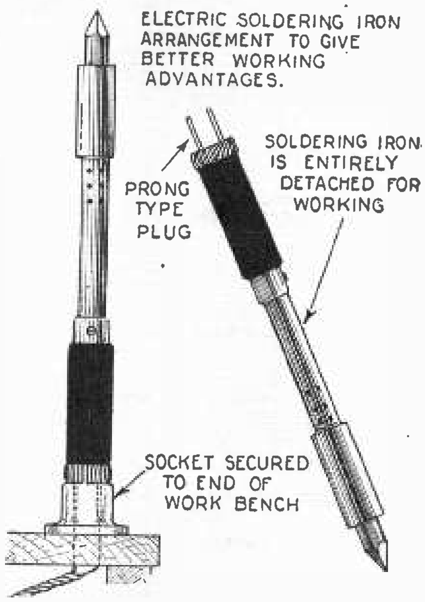
**And so, we close the $6,000.00 Astrology Contest with the hope that some day this would-be science shall become scientific enough to give us accurate information and with a few last words to those who have held their faith in astrology. The subject is interesting; it is even fascinating, but it holds no truth whatever.**

**We never anticipated nor expected that the astrologers would rally to their standards with the enthusiasm displayed by them, to paraphrase America's truth lover and emancipator, Abraham Lincoln. It is only fitting and proper that we should here give them the credit they so justly deserve. We salute the astrologers, not because they have been accurate, but because they have tried to demonstrate to the scientific world that astrology is scientific.**

## Hints for the Mechanic

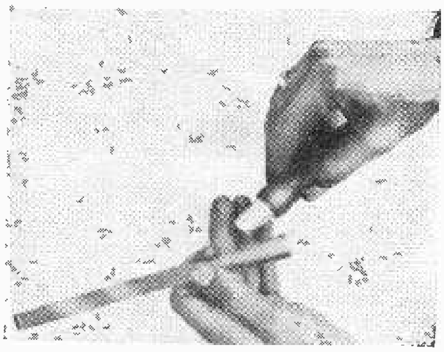
(*Continued from page* 819)

### IMPROVED SOLDERING IRON




A soldering iron arranged as shown above will be found to give excellent working advantages.—G. L.

### CHISEL KINK



When tapered ends of chisel handles become loose, they may be tightened by wrapping a few layers of tinfoil around the end.—F. W. Bentley, Jr.

## Solving Ship Power Secrets with Models

By G. H. DACY

(*Continued from page* 813)

The models in all cases are accurate replicas of the mammoth vessels which they represent. They are made of California redwood and are of a standard length of 20 feet. Some of them are tested to find out their ship power requirements by an electrical towing table which runs up and down the model basin. Others are equipped with minute electrical motors and produce their own power. Government engineers ascertain all there is to know about each model, its likes, dislikes, peculiarities and efficiencies.

For many years, guesswork was the chief guide of shipbuilding. Engineers and designers never knew exactly how much steam power would be required to operate a certain vessel until the ship was completed and made her trial trips. This condition obtained until about the time of the Civil War when a certain Englishman discovered that the power required to drive a ship could be estimated accurately from the power required to tow a small model of such a vessel. Model basins for testing Tom Thumb ships thus came into being and have multiplied so that there are now about 15 in the United States, England, France and Germany. There are only two in America, one at the University of Michigan and the other at the Washington Navy Yard.

The model basin at our National Capital is a massive structure of concrete, brick and steel equipped with complicated electrical and mechanical devices which assist in solving ship power conundrums. The inclosed concrete tank has a water surface 470 x 42 feet and is 14 feet deep along its median line. This proving ground of ship power accommodates 1,000,000 gallons of water and has been instrumental in improving the design, type, style and safety of American shipping. When Congress appropriated funds and authorized the construction of this model basin it stipulated that the naval experts should test models for commercial concerns or private individuals at cost whenever such agencies requested assistance. The result is that today the keel of a new type of ships is never laid until a miniature effigy of this vessel is tested in Washington's largest natatorium.

The electrical towing table plays the part of a marine mule and hauls the models back and forth through the water while technical recorders keep tab on the various responses of the little ship to service. Four 50 horsepower electric motors, governed by trolley wires, operate the towing carriage, which can be run at a speed range of from one-half a knot to 15 knots an hour.

This curious business of building models of proposed vessels is much more complicated than it sounds. The ship-builder provides specifications and geometrical representations of hull shape of the future ship. By means of special tools called pantographs—an engineering adaptation of a nursery toy—these technical figures are reduced to model dimensions. A dummy model is first made and then is duplicated by the use of a large electrical molding machine which reduces the raw redwood materials to the shape and semblance of a ship's hull. The final work on the model is done by hand, the diminutive ship being painted and varnished to render it impervious to moisture.

More than 2,700 models of naval and commercial vessels have been tested. Usually it takes about 15 days for the scientists and engineers to design and build the models, test them in the naval basin and translate the results into accurate figures of ship power which will be required by the future full size liner or cruiser. Savings of millions of dollars in ship construction have resulted from the sailing of toy ships in this Government pond. The case of a certain style of battleship which no longer is built is typical of the benefits which have accrued from model basin tests. As a result of the model experiments, naval science found out how it could save more than 2,000 horsepower in the amount required to drive this national ship merely by changing the design of her hull. Millions of tons of coal and billions of gallons of oil have been saved by the U. S. Government and commercial shipping concerns by the practical application of similar pointers gained from ship model experimentations.

Numerous ship propellers of all kinds have also been experimented with to determine their efficiency. It is always important to find out the secrets of the propeller's power distribution. The model may be equipped with four to six electrical motors, each of about one-eighth horsepower capacity. Each motor is linked to a small metal propeller of proportionate size. These propellers are linked to lilliputian shafting, exactly as they would be in a commercial boat. Mechanical recorders tabulate the power used.

## Simple Chemical Analyses

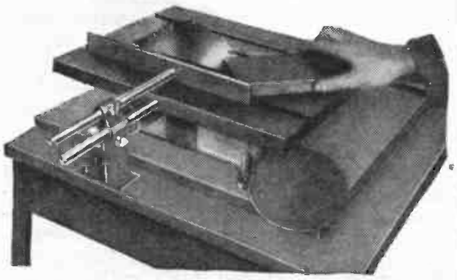
By RAYMOND B. WAILES

(*Continued from page* 817)

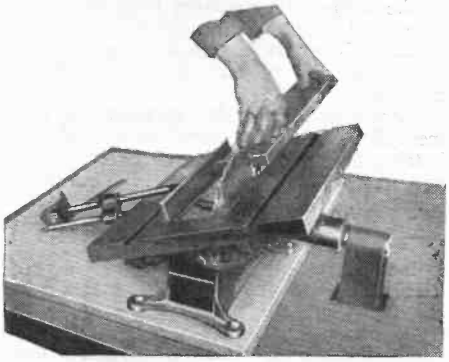
substance in water, or nitric acid. Neutralize with ammonia water, then add more ammonia water. This forms a jelly like precipitate of aluminum hydroxide. Filter this off and then heat the jelly precipitate on a charcoal block with a blowpipe. This will form aluminum oxide. Now touch the white mass with a drop of DILUTE solution of cobalt nitrate and heat again. If a blue color is formed, aluminum is present.

Tea which has been boiled or allowed to steep for some time is very bitter. This is due to the extraction of tannic acid or tanment. Make tea in the usual way and collect a test tube of it. Now boil several minutes and collect. On adding a solution of ferric chloride or ferrous sulphate to the tubes of tea, a coloration is formed in both tubes, but the tube containing the boiled tea will be much darker or denser in color than the properly made tea, because more iron tannate forms.

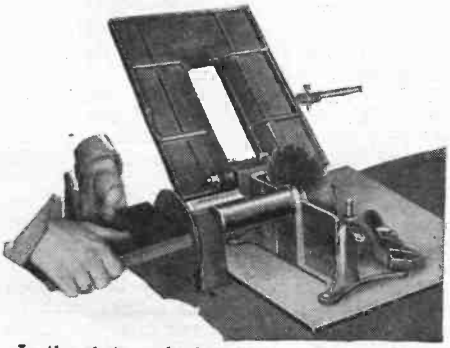
## USEFUL SAW TABLE



**The above photograph shows the use of both guide and an adjustable angle so that the wood will be cut at a predetermined angle. This saw table can be adjusted for depth of cut with both an instantaneous adjustment and a micrometric adjustment. It is, therefore, possible to rabbet and do other work not generally possible with motored saws.**



**Another view of the saw table, this time tilted so as to produce a beveled edge. Ball bearings permit the use of a small motor.**



**In the photograph above we find the new saw table raised so as to show the construction and the sandpaper disk in place for sanding the edges of the cut wood. The vertical screw just in front of the saw is the means for adjusting the height of the saw table.**

*Photos courtesy Ralph M. Kennedy*

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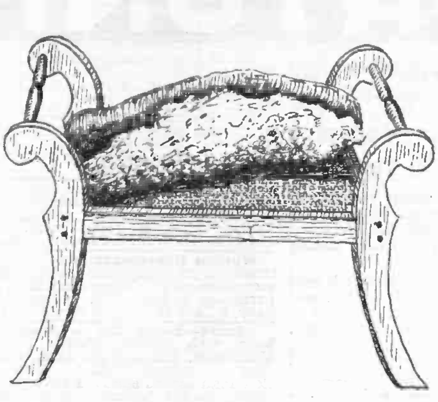
## Building a Colonial Type Footstool

By H. L. WEATHERBY

(*Continued from page* 811)

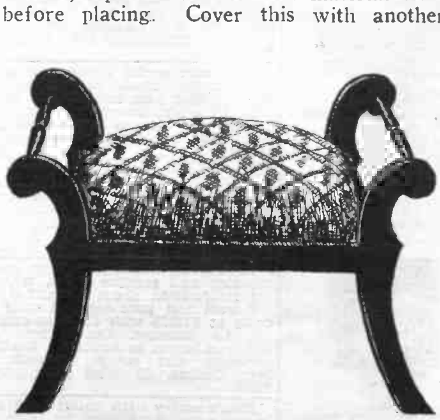


**Cover webbing with layer of burlap, or denim, next, and add cotton padding, hair or moss, well distributed to give a good appearance. Cover this with thickness of denim or other strong cloth stretched tight and tacked. Stain, varnish and rub the footstool before last step in upholstering.**

Next, when the glue has thoroughly set on the sides, attach the end rails, being absolutely certain that the ends of the pieces are square both ways. Attach with two 1¾" No. 9 flat head screws at each joint, countersinking them to a depth of about ⅜" and later filling the countersink holes with wooden plugs or dowels. The rounds which must be placed at this time are glued in position and held with clamps.

Square the footstool up carefully, and tack a diagonal strip across the rails if necessary, to hold it in that position while the corner blocks set. These pieces should be rubbed into position, all air being forced out and suction holding them tight while the glue is setting, no clamps being required. It is best to wait another twenty-four hours before attaching the cleats to the rails, which should be done with screws.

Following this, we are ready to upholster. The illustrations cover the steps very well. Weave the webbing as shown, stretch each piece tight and tack with eight ounce carpet tacks. Cover this with a thickness of burlap, denim or any other good strong cloth, stretching tight and tacking to the cleats. If cotton is used, secure the cotton batting and lay to desired thickness, or if hair or moss is used, separate and fluff the material well, before placing. Cover this with another



**Smooth out any irregularities left in previous step by placing a smooth thin layer of cotton over denim, then tack tapestry in place, stretching tight. Finish upholstering job by using gimp around the edges and ends to hide ragged edges of cloth, tacking with gimp tacks.**

thickness of cloth, then, before attaching the final cover, which may be tapestry or velour, stain, shellac, and varnish with about two coats of good rubbing varnish. After rubbing the final coat with ground pumice and oil, level out any inequalities in the upholstering job with a thin layer of cotton, then tack the tapestry or velour cover around the edges, pulling tight and even. To cover the ragged edges of the materials showing, use gimp of a color to match, attaching with gimp tacks.

If carefully made, the final results will be most pleasing. By slight increases in all dimensions a very comfortable chair size seat can be made from the same drawing.

## Electrical Show in New York

(*Continued from page* 801)

lently. The weight of the entire machine, including the bracket, is but 21 pounds, and the apparatus will handle three sheets at a time.

Among the new lighting appliances we find a unique shade made of celluloid, which produces a very artistic effect and a pleasing, translucent glow.

Then there is a washing machine which also fits into the tub and which oscillates a pair of vacuum cups in the water, thus taking care of the clothes. This washing machine has a wringer attachment instantly connected with the motor, but it is more unusual than the average type of machine. The designer figured that there was no need of merely selling a washing machine to his consumers, with the intention of having them use it for that purpose alone. He saw the possibility of using the same motor for the operation of ice cream apparatus, churns, meat choppers, cream whippers, etc., so within a short time, those who are fortunate enough to secure one of these washing machines will find that the motor serves a general all-around utility purpose.

Elsewhere in the exhibition we find a sun lamp; an ultra-violet ray producer which can be employed for home treatment. Ultra-violet light, as everyone knows, is of great value in various medical treatments. These penetrating rays are used on children daily for relieving the condition known as rickets. The apparatus likewise has many other uses.

For some reason or other we cannot seem to get away from the washing machines, and so we will describe the last one in this group. After washing the clothes, they are put in a porcelain enameled spinner. This enameled truncated cone-shaped drier is not perforated in any way, but the water rises to the top and spins out, leaving the clothes dry enough to place on the line or else to iron.

There is also a floor polisher and waxer, which will wash linoleum and wax it or scrub and wax wooden floors. It contains three revolving scrubbing brushes and although the apparatus is heavy enough to keep it in contact with the floor, it can be easily directed and controlled by guiding with but one finger.

Among the coffee urns and percolators, we find those with a thermostatic button on the bottom. In event that the water should happen to boil out of the percolator, the thermostat automatically cuts off the current supply. Pressing on the button reestablishes the circuit.

And last, but not least, there is a very clever Christmas tree stand decorated with poinsettia flowers and colored bulbs and fitted with two outlets for tree lamps. The center contains a well for water to keep the tree fresh over a greater period of time.

(*Addresses of manufacturers gladly furnished upon request.*)

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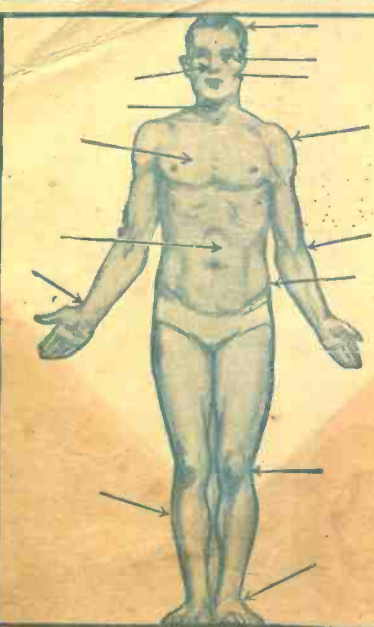

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